

Magnetic measurements of MCBRDP2

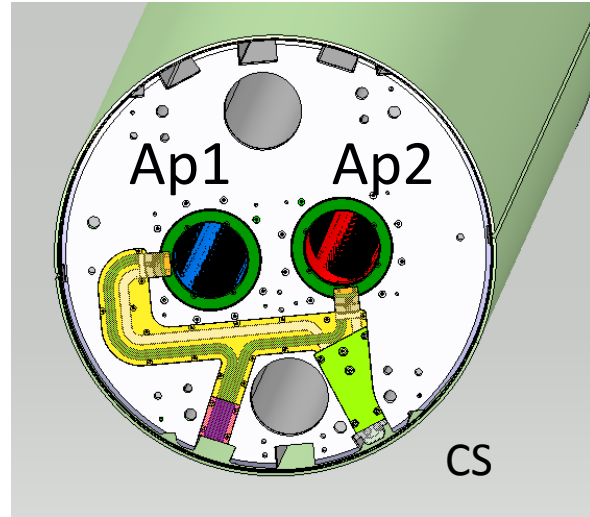
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Outline

- Naming convention
- Tests at 1.9 K
- Tests at ambient temperature
- Comparison
 - MCBRDP1
- Conclusions

Naming convention



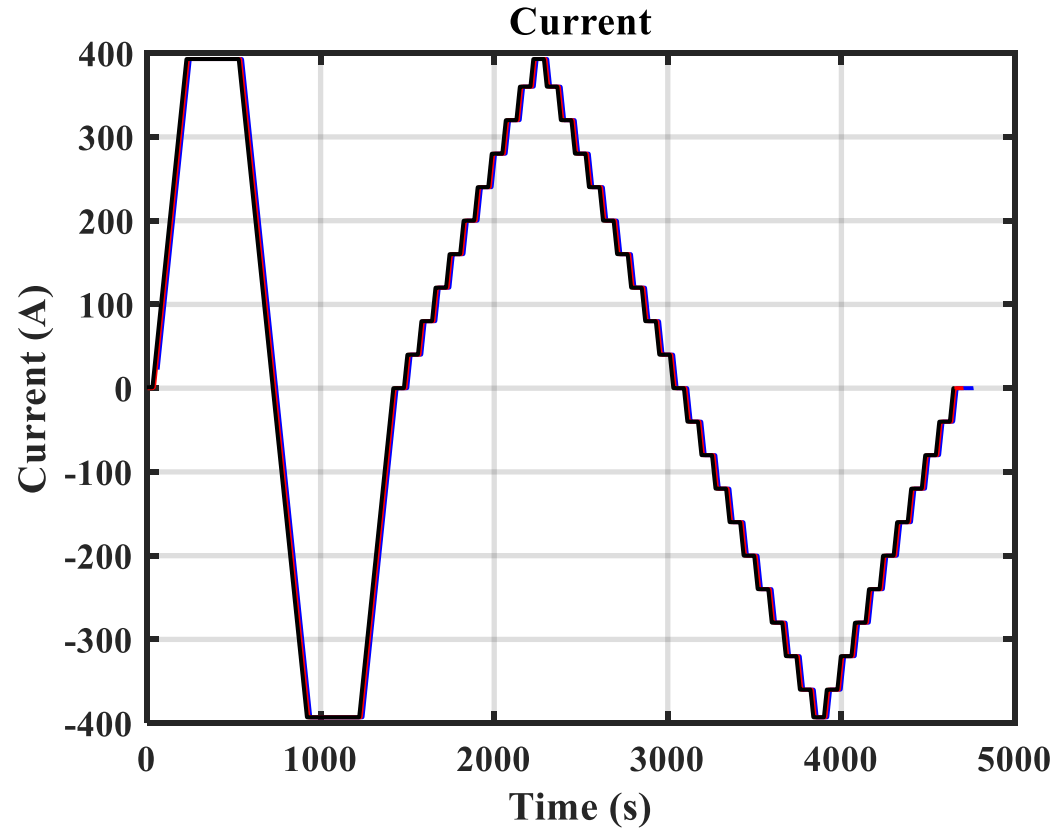
By convention, looking from connection side:

- Vertical field in Ap 1 (left)
- Horizontal field Ap 2 (right)

Tests at 1.9 K

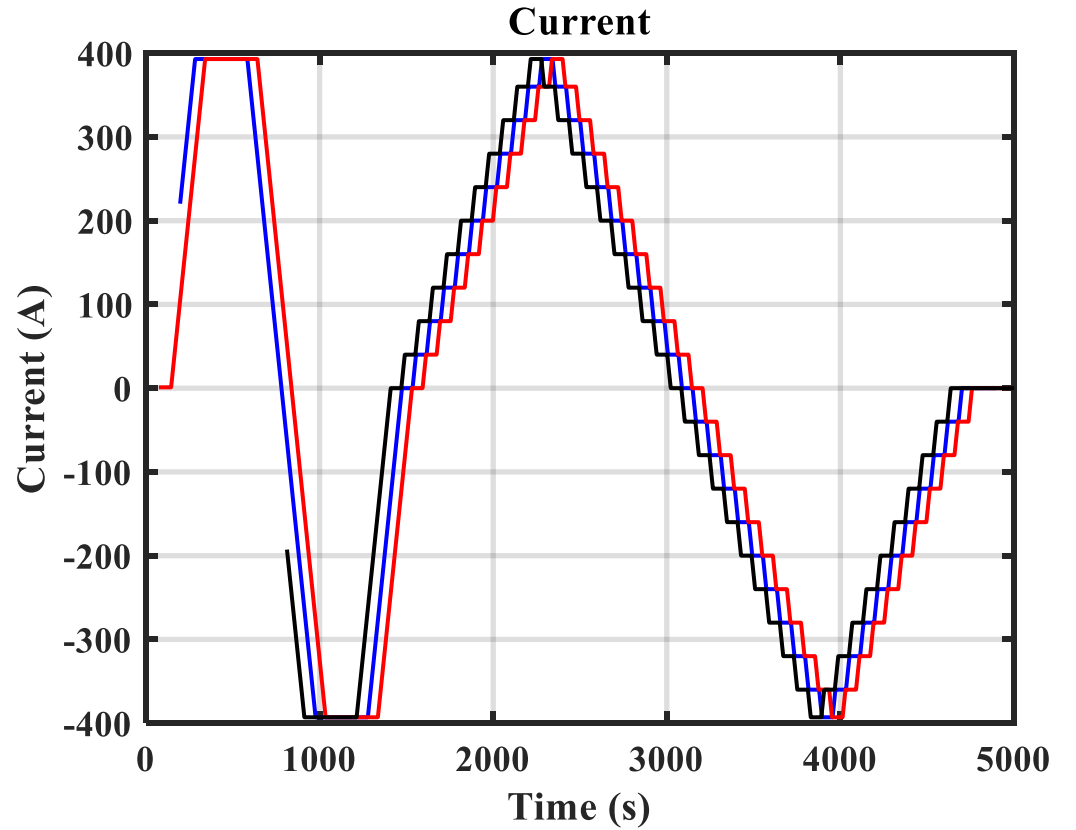
- Standard cycles
 - On Ap1 staircase up to nominal (5 Tm and 393 A)
 - while 0 A in Ap2
 - while +393 A in Ap2
 - while -393 A in Ap2
 - On Ap2 staircase up to nominal (5 Tm and 393 A)
 - while 0 A in Ap1
 - while +393 A in Ap1
 - while -393 A in Ap1
- Special cycles (additional slides)
 - 5 Tm (393 A) in Ap1 and 1 Tm (80 A) in Ap2
 - 4 Tm (314 A) in Ap1 and 0.5 Tm (40 A) in Ap2

Current



Ap1 stair step

Ap2 0 A, Ap2 -393 A, Ap2 +393 A



Ap2 stair step

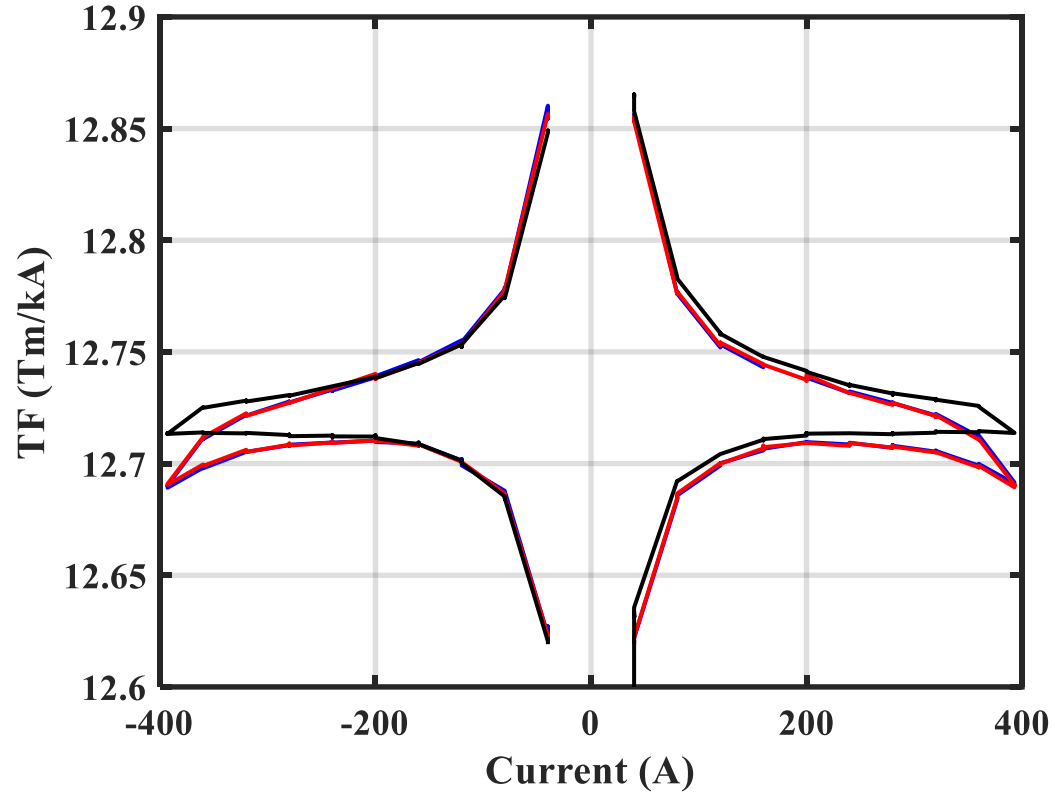
Ap1 0 A, Ap1 -393 A, Ap1 +393 A

TF

12.713 Tm/kA at 393 A (0 A in Ap2)

12.690 Tm/kA at 393 A (+/- 393 A in Ap2)

Normal field



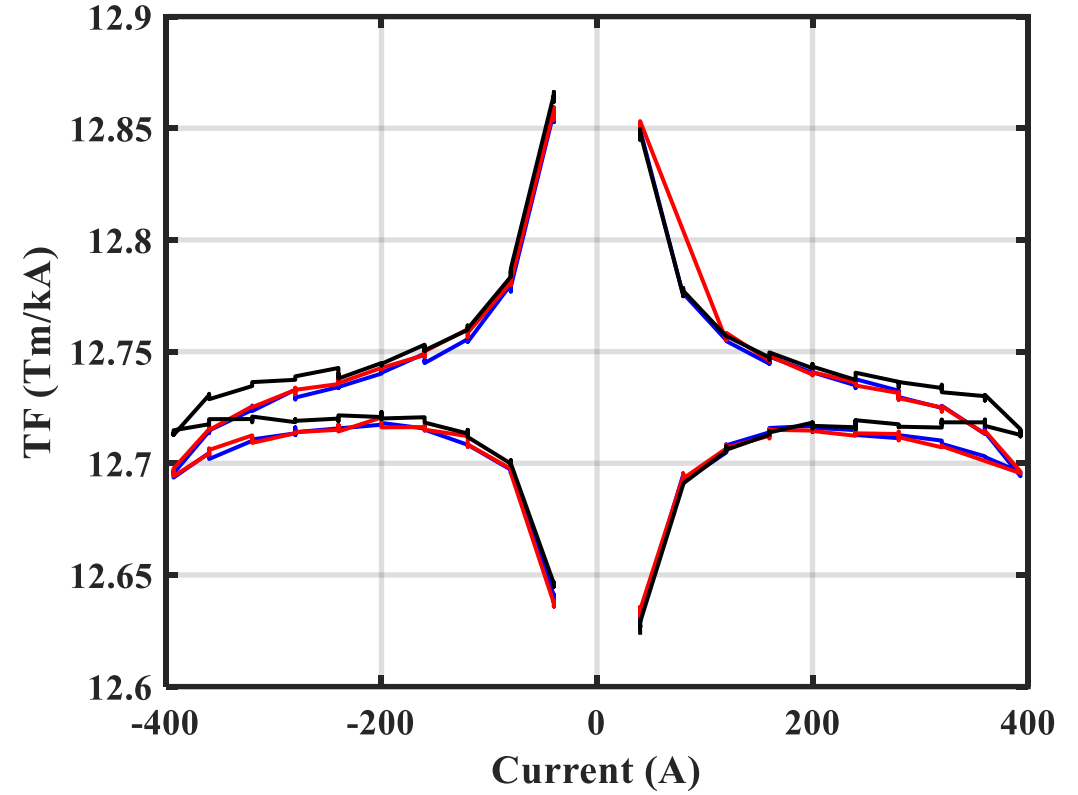
Ap1 stair step

Ap2 0 A, Ap2 -393 A, Ap2 +393 A

1.2715 Tm/kA at 393 A (0 A in Ap1)

1.2698 Tm/kA at 393 A (+/- 393 A in Ap2)

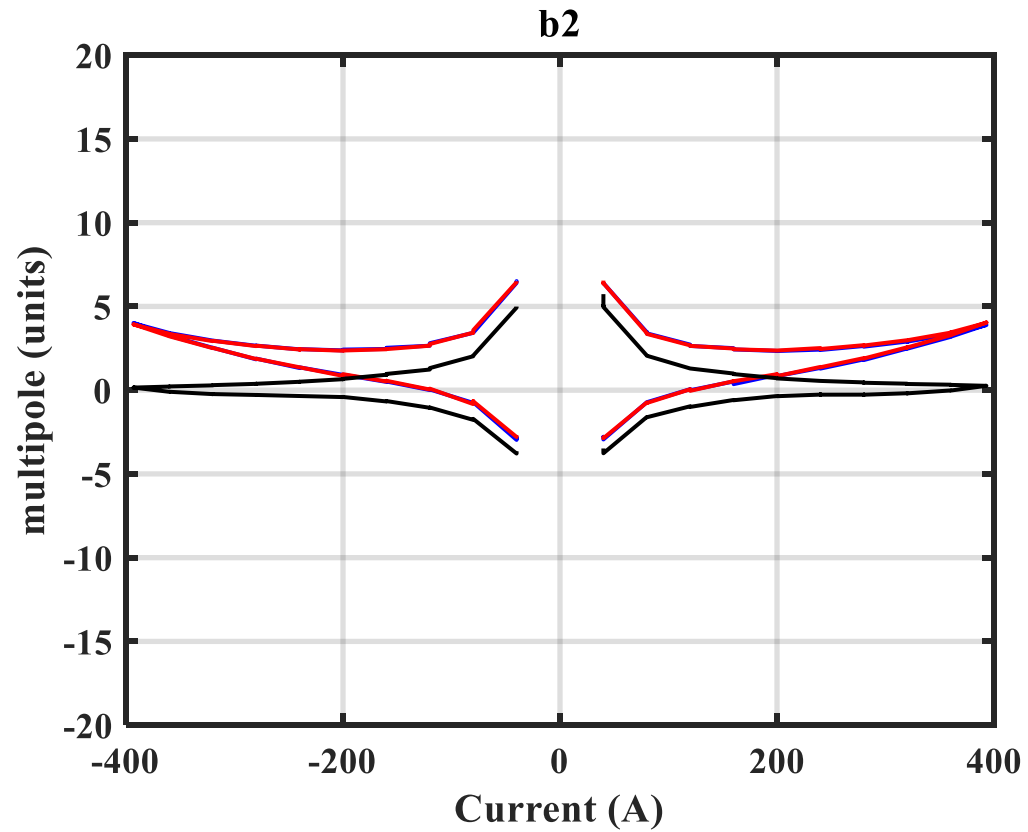
Skew field



Ap2 stair step

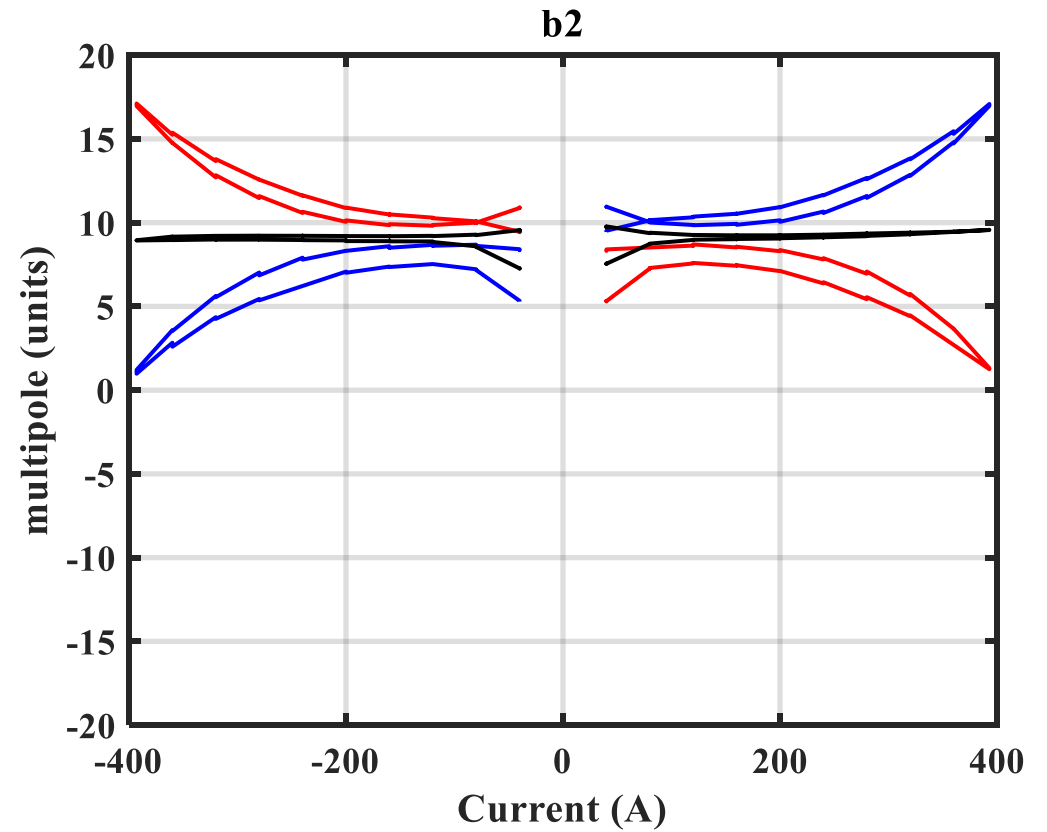
Ap1 0 A, Ap1 -393 A, Ap1 +393 A

b2



Ap1 stair step

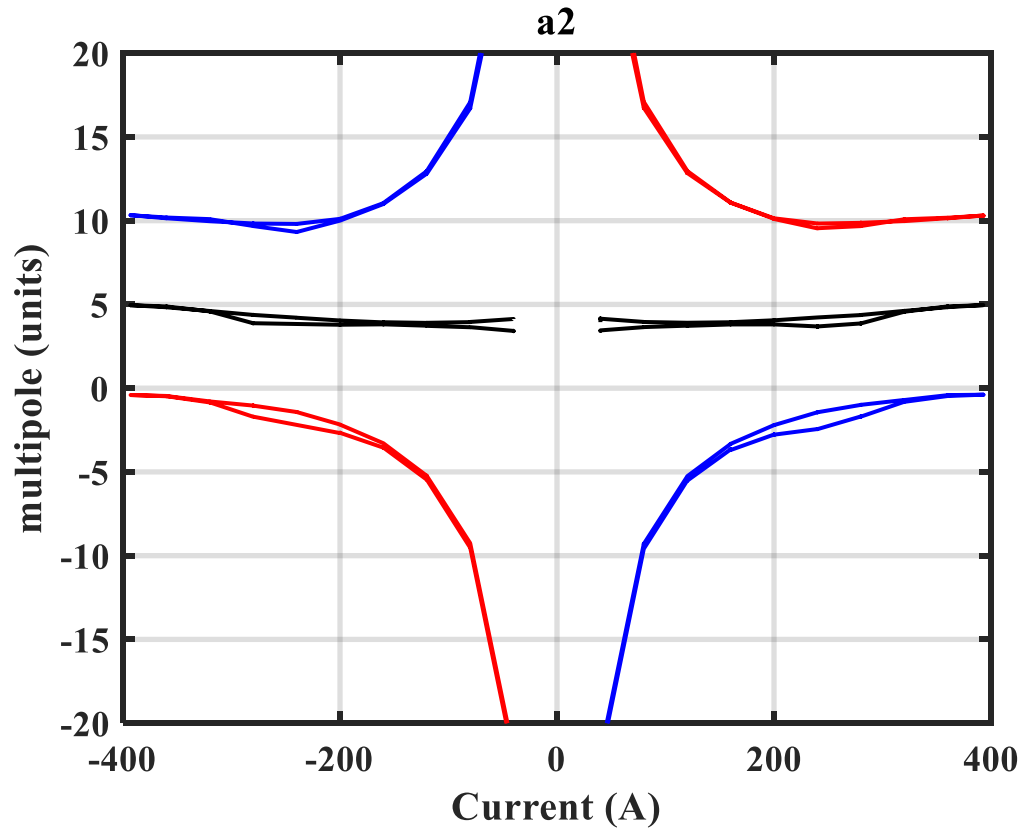
Ap2 0 A, Ap2 -393 A, Ap2 +393 A



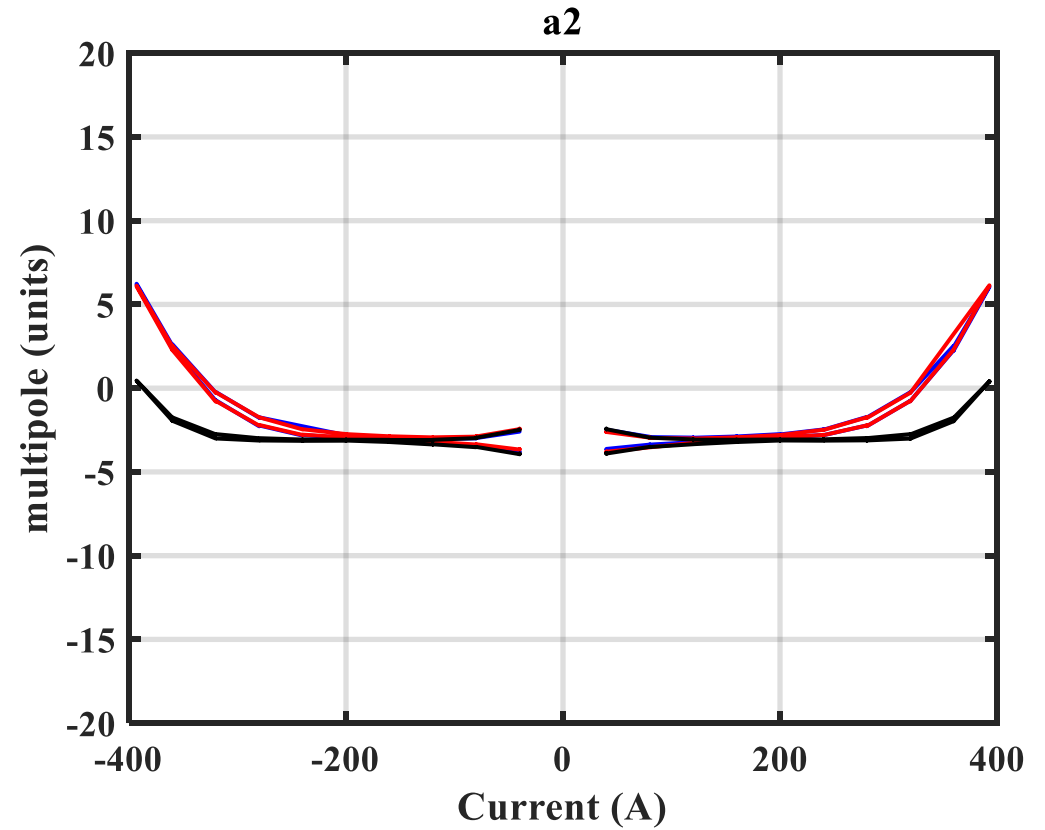
Ap2 stair step

Ap1 0 A, Ap1 -393 A, Ap1 +393 A

a2

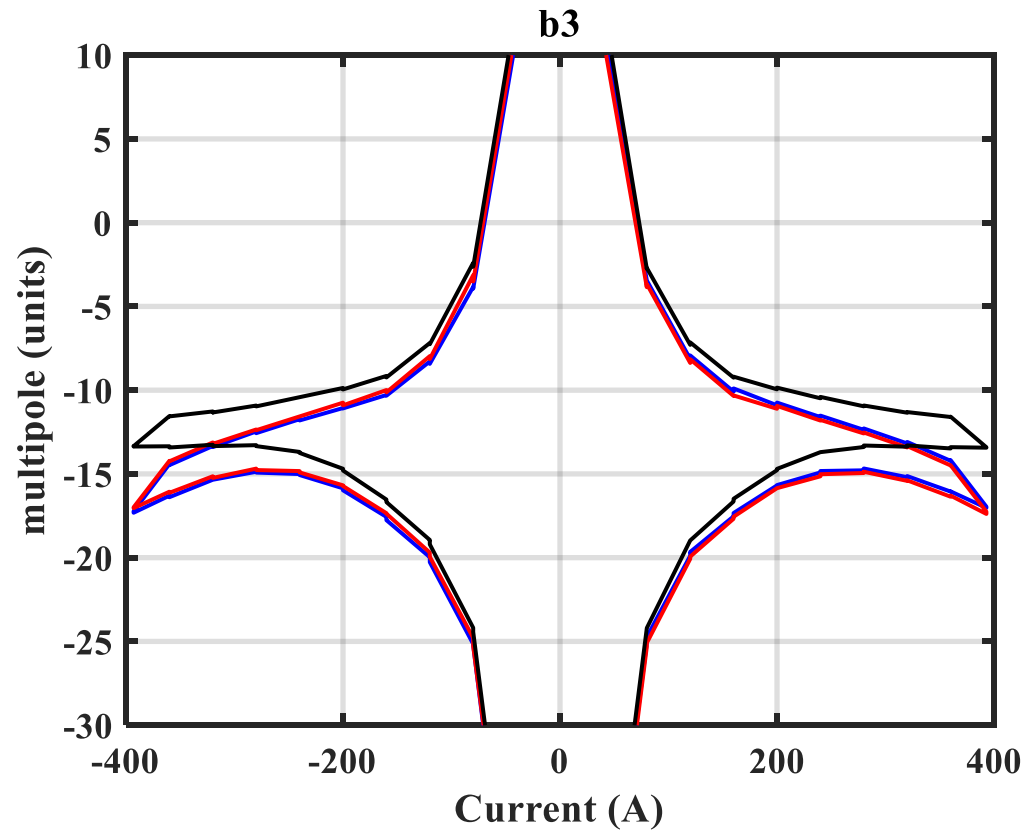


Ap1 stair step
Ap2 0 A, Ap2 -393 A, Ap2 +393 A



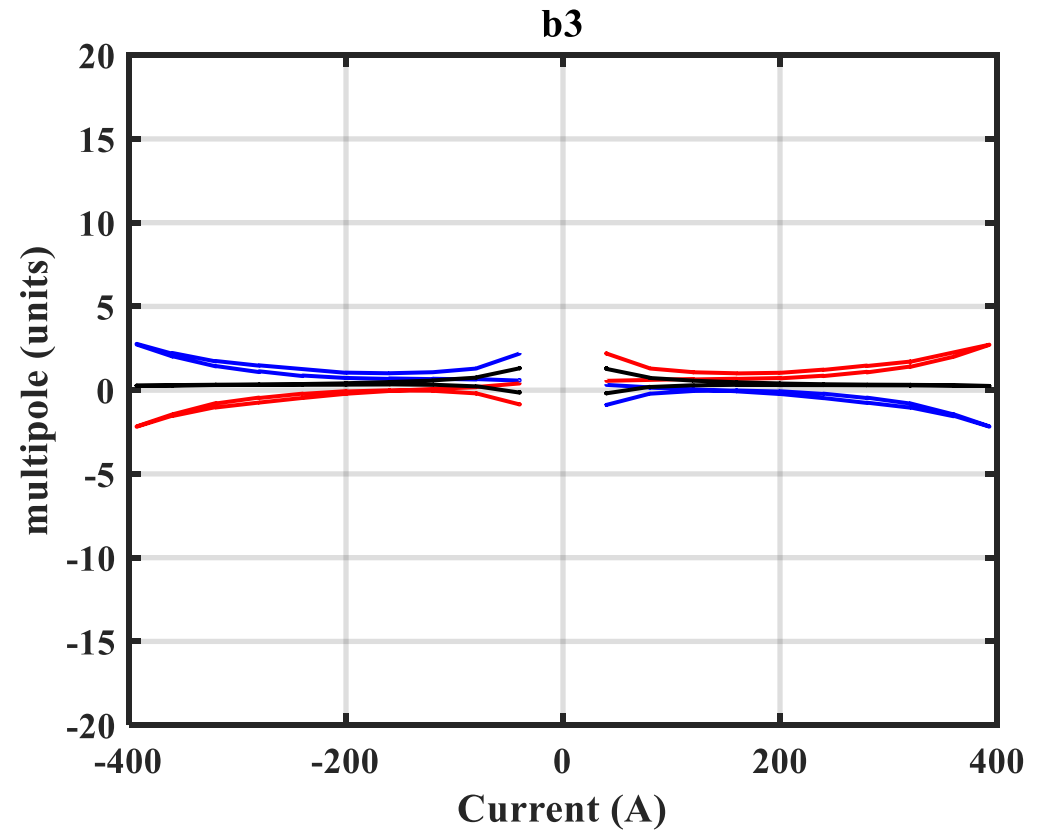
Ap2 stair step
Ap1 0 A, Ap1 -393 A, Ap1 +393 A

b3



Ap1 stair step

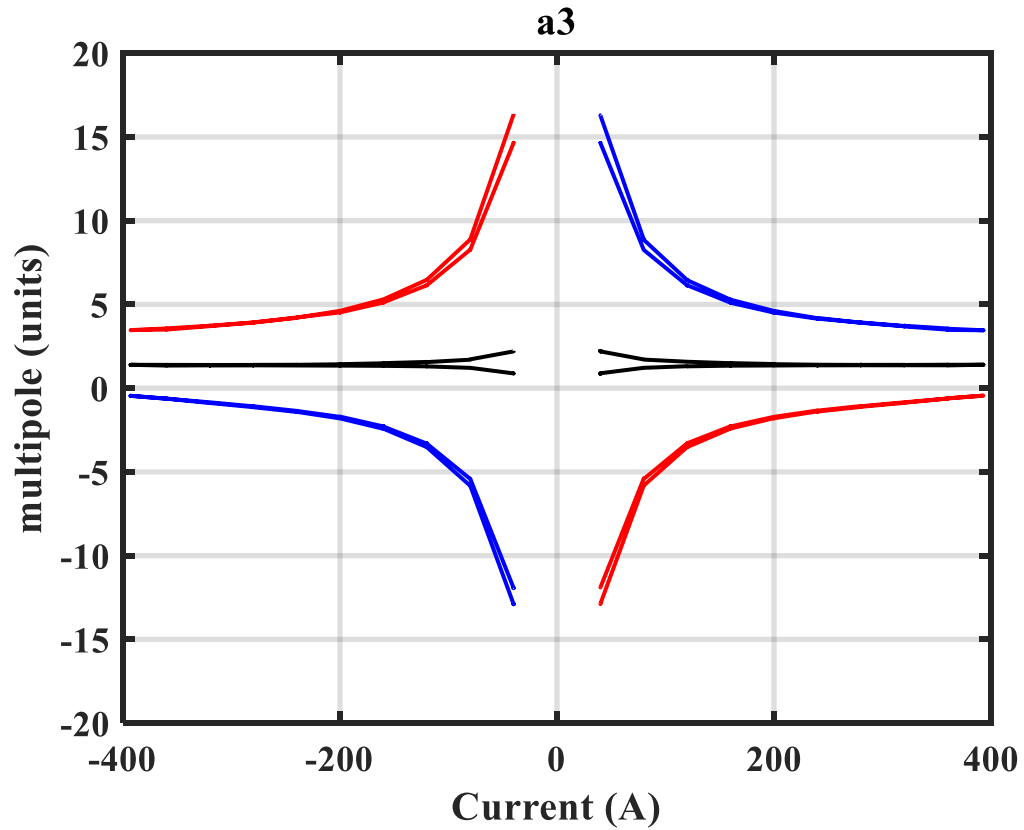
Ap2 0 A, Ap2 -393 A, Ap2 +393 A



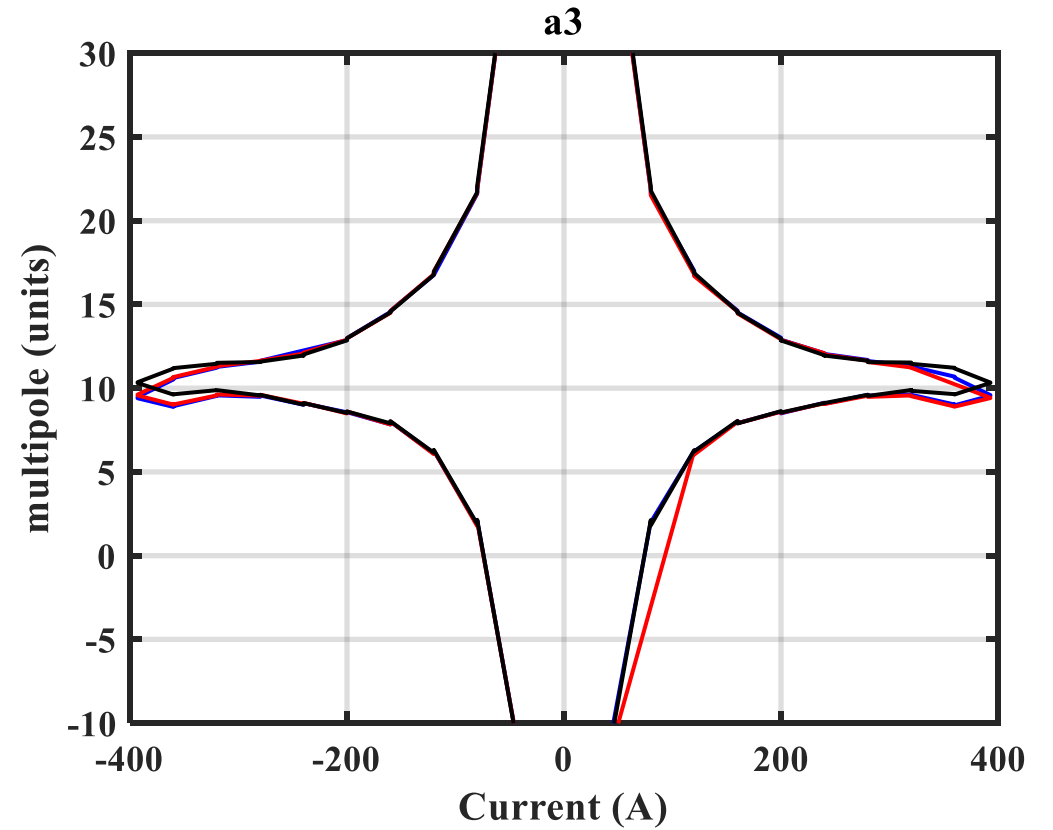
Ap2 stair step

Ap1 0 A, Ap1 -393 A, Ap1 +393 A

a3

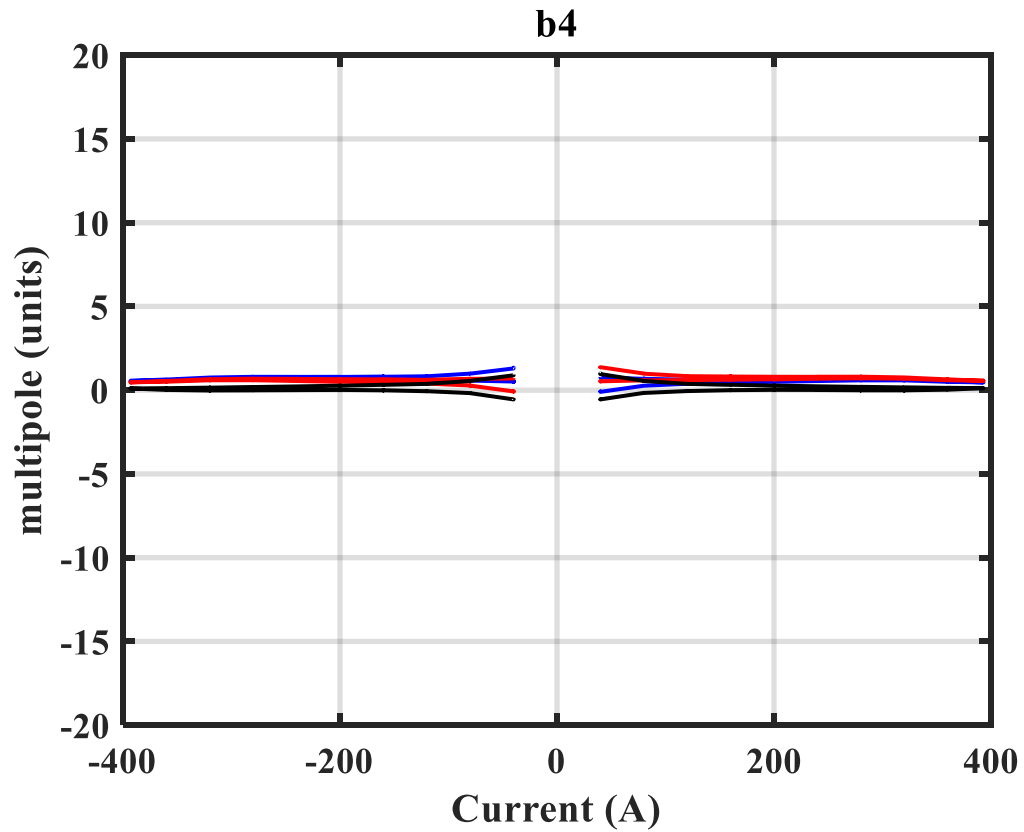


Ap1 stair step
Ap2 0 A, Ap2 -393 A, Ap2 +393 A



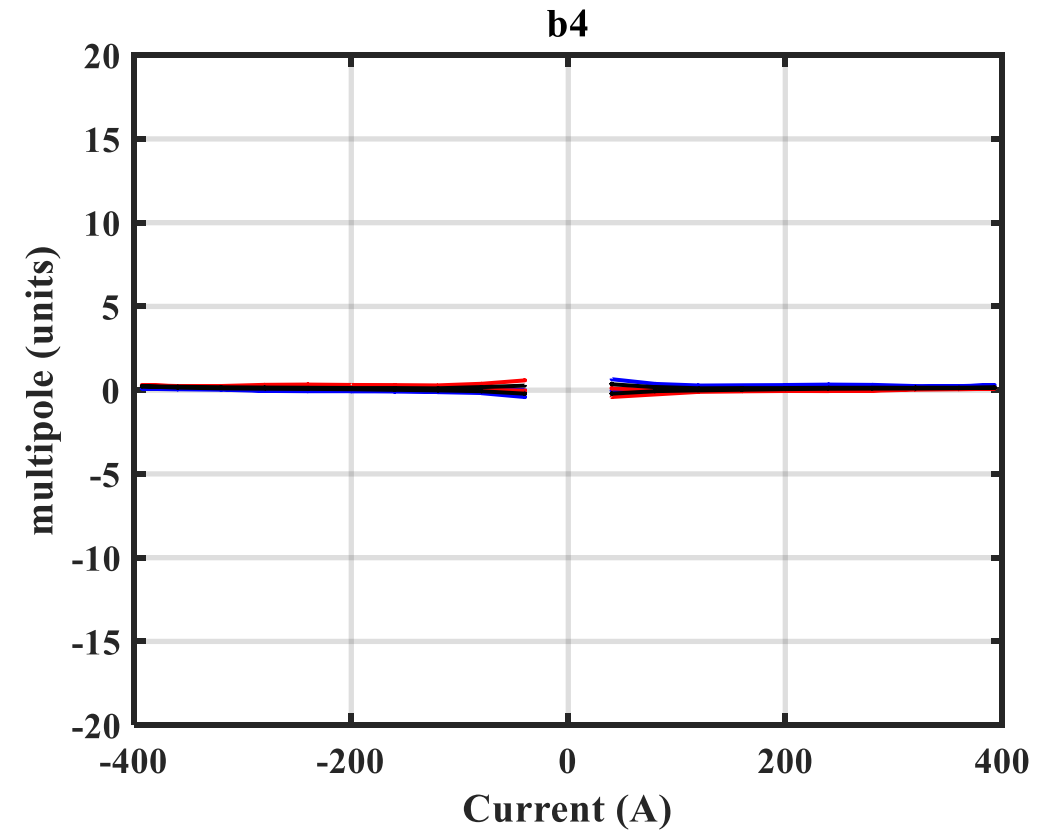
Ap2 stair step
Ap1 0 A, Ap1 -393 A, Ap1 +393 A

b4



Ap1 stair step

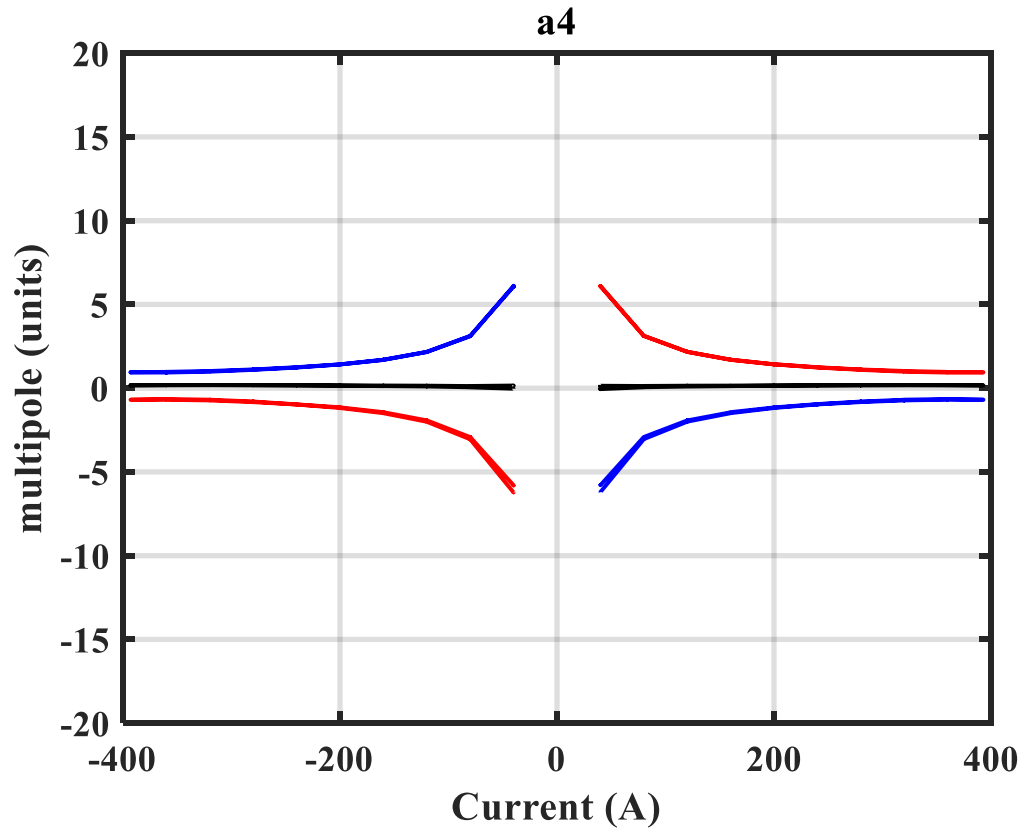
Ap2 0 A, Ap2 -393 A, Ap2 +393 A



Ap2 stair step

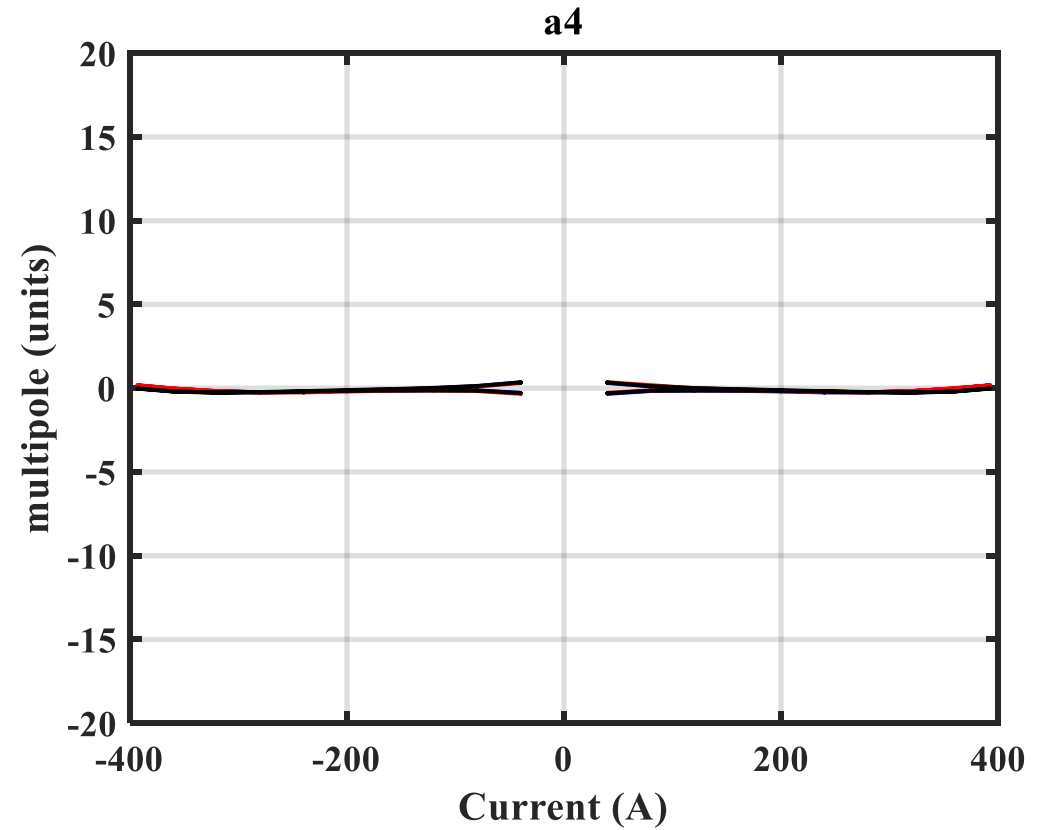
Ap1 0 A, Ap1 -393 A, Ap1 +393 A

a4



Ap1 stair step

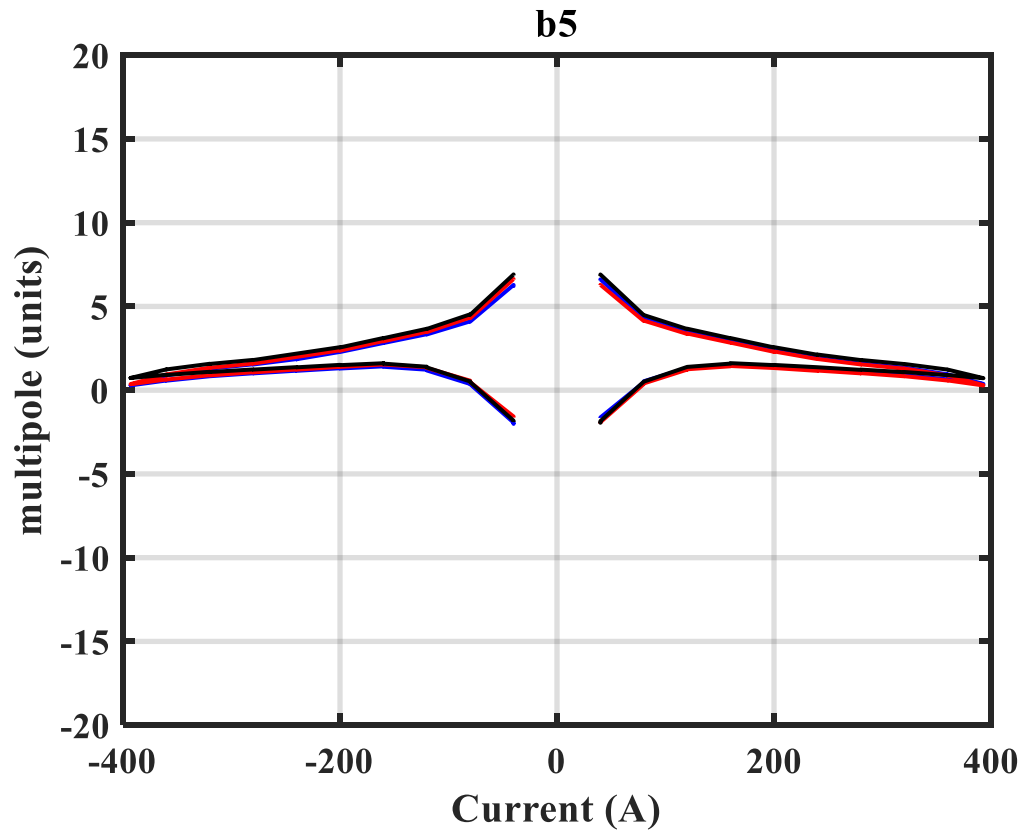
Ap2 0 A, Ap2 -393 A, Ap2 +393 A



Ap2 stair step

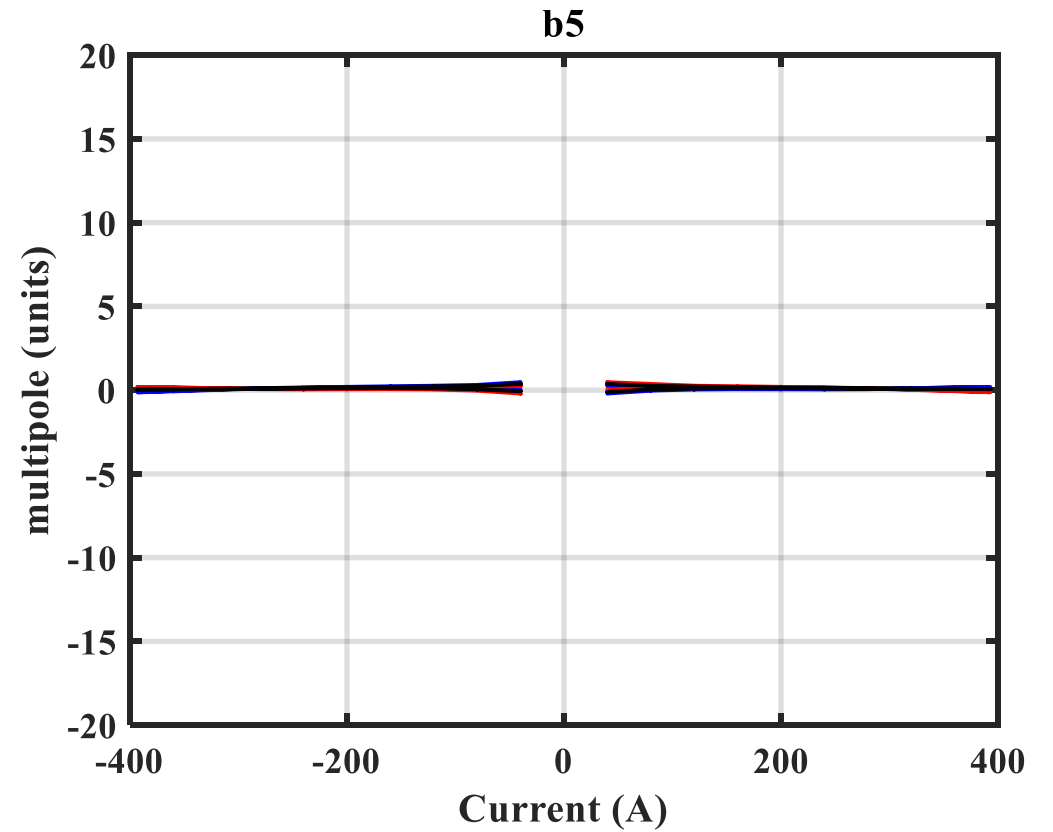
Ap1 0 A, Ap1 -393 A, Ap1 +393 A

b5



Ap1 stair step

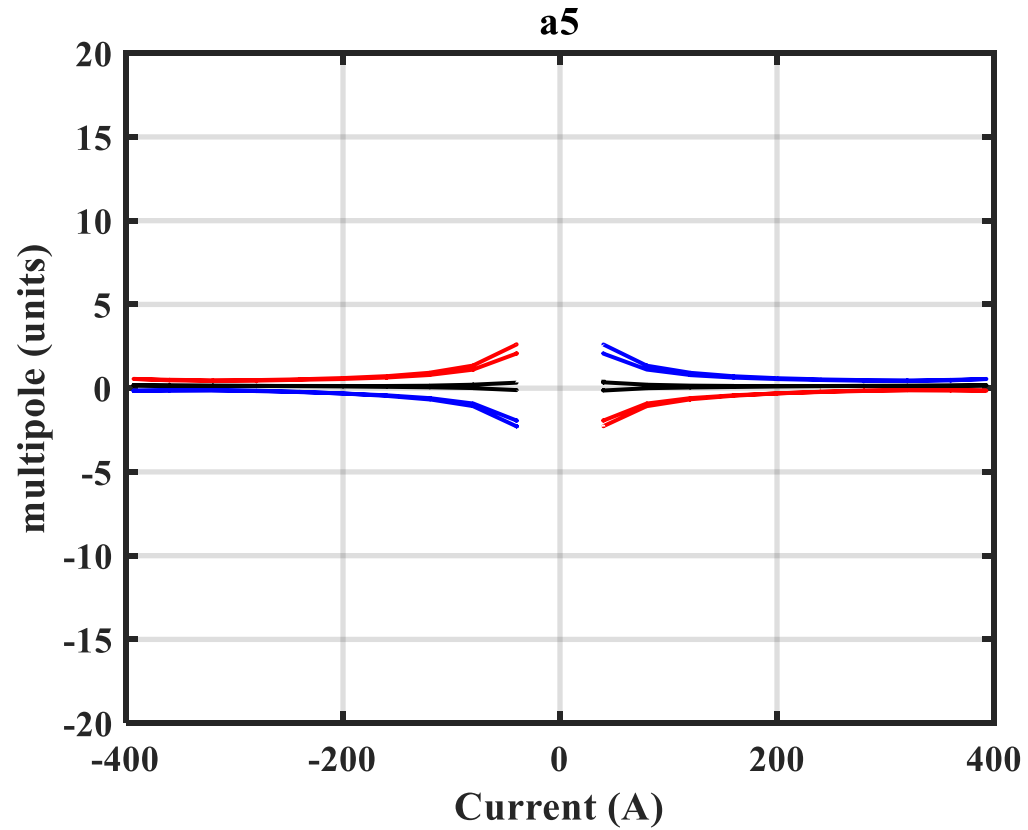
Ap2 0 A, Ap2 -393 A, Ap2 +393 A



Ap2 stair step

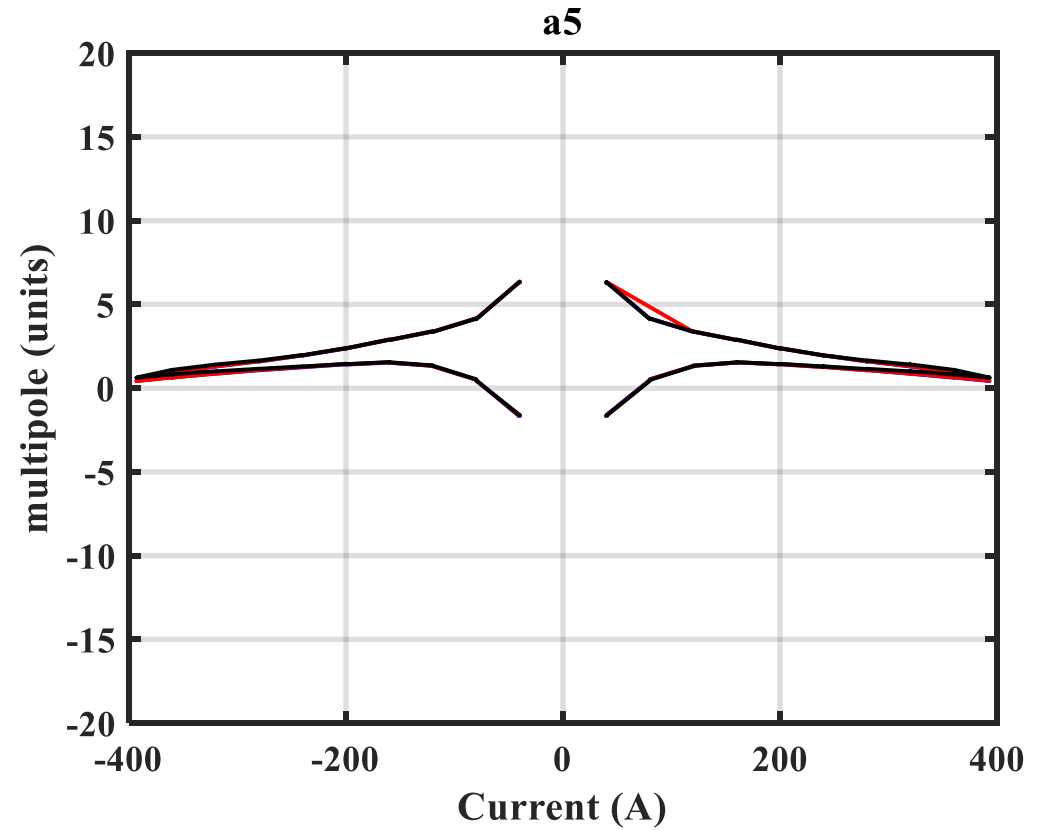
Ap1 0 A, Ap1 -393 A, Ap1 +393 A

a5



Ap1 stair step

Ap2 0 A, Ap2 -393 A, Ap2 +393 A



Ap2 stair step

Ap1 0 A, Ap1 -393 A, Ap1 +393 A

FQ Tables

Rref = 35 mm

AP1 393 A								
AP2 0 A			AP2 -393 A			AP2 393 A		
B1 [Tm]	4.9965		4.9877			4.9871		
n	bn	an	n	bn	an	n	bn	an
1	10000	1	1	10000	10	1	10000	-9
2	0.27	5.00	2	3.88	-0.40	2	4.05	10.32
3	-13.41	1.39	3	-16.93	3.43	3	-17.20	-0.44
4	0.12	0.16	4	0.46	-0.69	4	0.56	0.94
5	0.72	0.17	5	0.37	0.54	5	0.30	-0.15
6	0.03	-0.05	6	0.00	-0.17	6	0.03	0.08
7	-0.24	0.04	7	-0.25	0.08	7	-0.27	0.00
8	0.00	0.02	8	-0.02	0.00	8	-0.02	0.03
9	-0.03	0.01	9	-0.02	0.02	9	-0.02	0.00
10	0.00	0.01	10	0.00	0.01	10	0.00	0.01
11	-0.03	0.01	11	-0.03	0.01	11	-0.03	0.01
12	0.00	0.00	12	0.00	0.00	12	0.00	0.00
13	0.00	0.00	13	0.00	0.00	13	0.00	0.00
14	0.00	0.00	14	0.00	0.00	14	0.00	0.00
15	0.00	0.00	15	0.00	0.00	15	0.00	0.00

AP2 393 A								
A1 [Tm] 4.9964			4.9894			4.9893		
n	bn	an	n	bn	an	n	bn	an
1	-67	10000	1	-76	10000	1	-58	10000
2	9.57	0.40	2	17.06	6.09	2	1.30	6.13
3	0.25	10.33	3	-2.19	9.50	3	2.71	9.35
4	0.15	-0.02	4	0.30	0.17	4	0.09	0.15
5	0.06	0.63	5	0.18	0.44	5	-0.12	0.46
6	-0.12	-0.03	6	-0.18	0.06	6	-0.06	0.05
7	0.03	0.29	7	0.06	0.27	7	0.00	0.28
8	0.01	0.01	8	0.00	0.01	8	0.03	0.01
9	-0.01	-0.01	9	0.00	-0.02	9	-0.02	-0.02
10	-0.01	0.00	10	-0.01	0.00	10	0.00	0.00
11	0.01	0.02	11	0.01	0.02	11	0.01	0.02
12	0.00	0.00	12	0.00	0.00	12	0.00	0.00
13	0.00	0.00	13	0.00	0.00	13	0.00	0.00
14	0.00	0.00	14	0.00	0.00	14	0.00	0.00
15	0.00	0.00	15	0.00	0.00	15	0.00	0.00

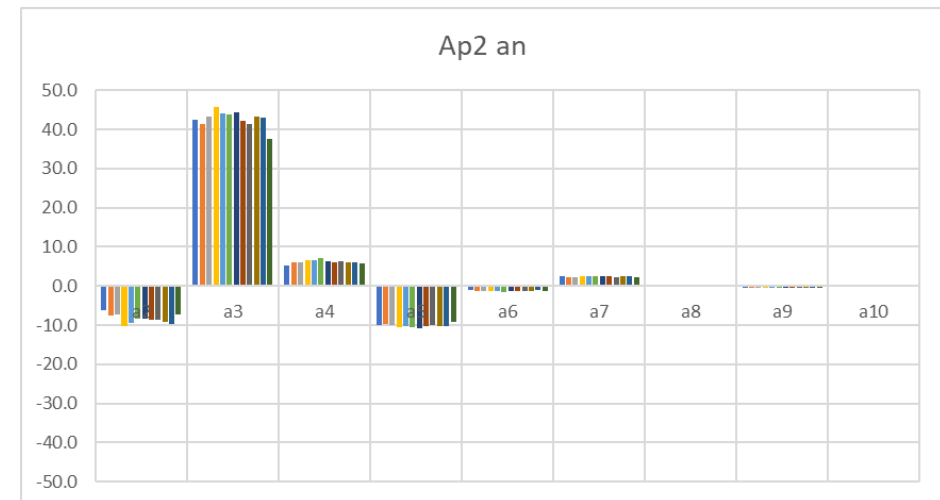
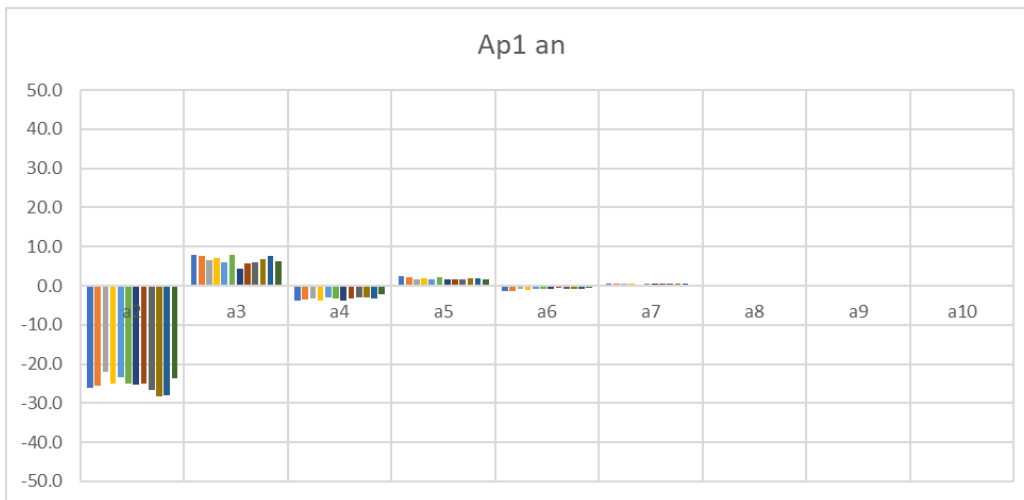
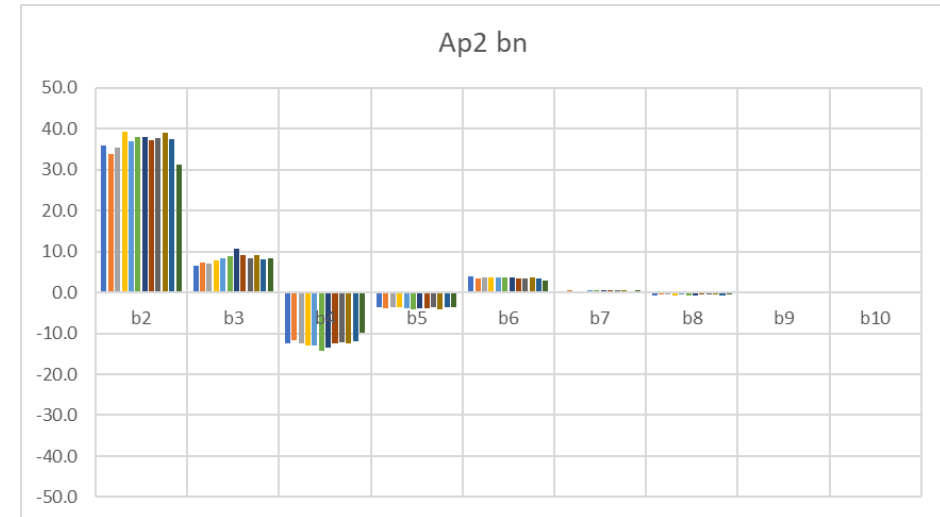
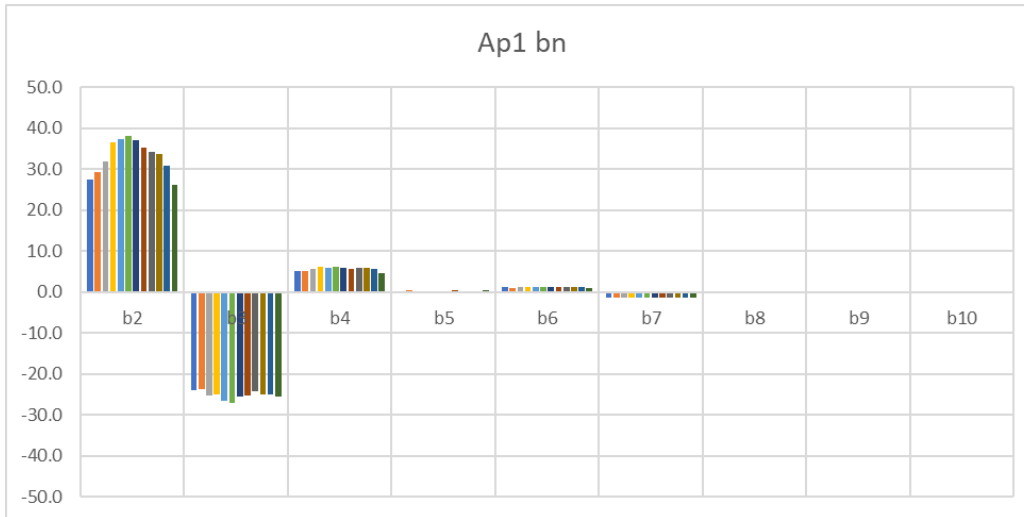
AP1 -393 A								
B1 [Tm]	4.9964		4.9877			4.9877		
n	bn	an	n	bn	an	n	bn	an
1	10000	1	1	10000	-11	1	10000	9
2	0.15	4.95	2	4.00	10.34	2	3.93	-0.41
3	-13.29	1.39	3	-17.17	-0.44	3	-16.95	3.47
4	0.10	0.17	4	0.56	0.93	4	0.47	-0.69
5	0.74	0.17	5	0.31	-0.15	5	0.37	0.55
6	0.03	-0.04	6	0.03	0.08	6	0.00	-0.18
7	-0.23	0.04	7	-0.26	0.00	7	-0.25	0.09
8	0.00	0.02	8	-0.01	0.03	8	-0.02	0.00
9	-0.03	0.01	9	-0.02	0.00	9	-0.02	0.02
10	0.00	0.01	10	0.00	0.01	10	0.00	0.01
11	-0.03	0.01	11	-0.03	0.01	11	-0.03	0.01
12	0.00	0.00	12	0.00	0.00	12	0.00	0.00
13	0.00	0.00	13	0.00	0.00	13	0.00	0.00
14	0.00	0.00	14	0.00	0.00	14	0.00	0.00
15	0.00	0.00	15	0.00	0.00	15	0.00	0.00

AP2 -393 A								
A1 [Tm]	4.9962		4.9893			4.9897		
n	bn	an	n	bn	an	n	bn	an
1	-67	10000	1	-60	10000	1	-75	10000
2	8.94	0.45	2	1.20	6.20	2	16.88	6.06
3	0.27	10.29	3	2.74	9.36	3	-2.15	9.51
4	0.23	-0.02	4	0.09	0.15	4	0.32	0.17
5	0.02	0.63	5	-0.13	0.46	5	0.18	0.45
6	-0.12	-0.03	6	-0.06	0.05	6	-0.17	0.06
7	0.03	0.29	7	0.00	0.28	7	0.06	0.27
8	0.01	0.01	8	0.03	0.01	8	0.00	0.02
9	-0.01	-0.01	9	-0.02	-0.02	9	0.00	-0.02
10	-0.01	0.00	10	0.00	0.00	10	-0.01	0.00
11	0.01	0.02	11	0.01	0.02	11	0.01	0.02
12	0.00	0.00	12	0.00	0.00	12	0.00	0.00
13	0.00	0.00	13	0.00	0.00	13	0.00	0.00
14	0.00	0.00	14	0.00	0.00	14	0.00	0.00
15	0.00	0.00	15	0.00	0.00	15	0.00	0.00

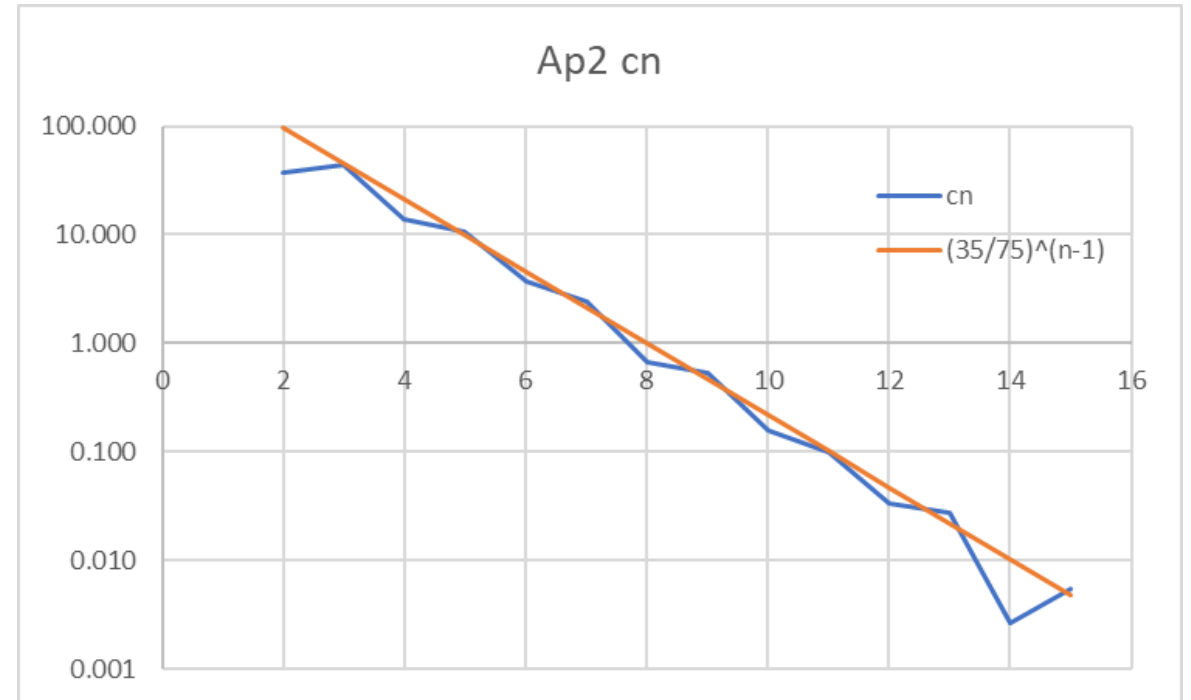
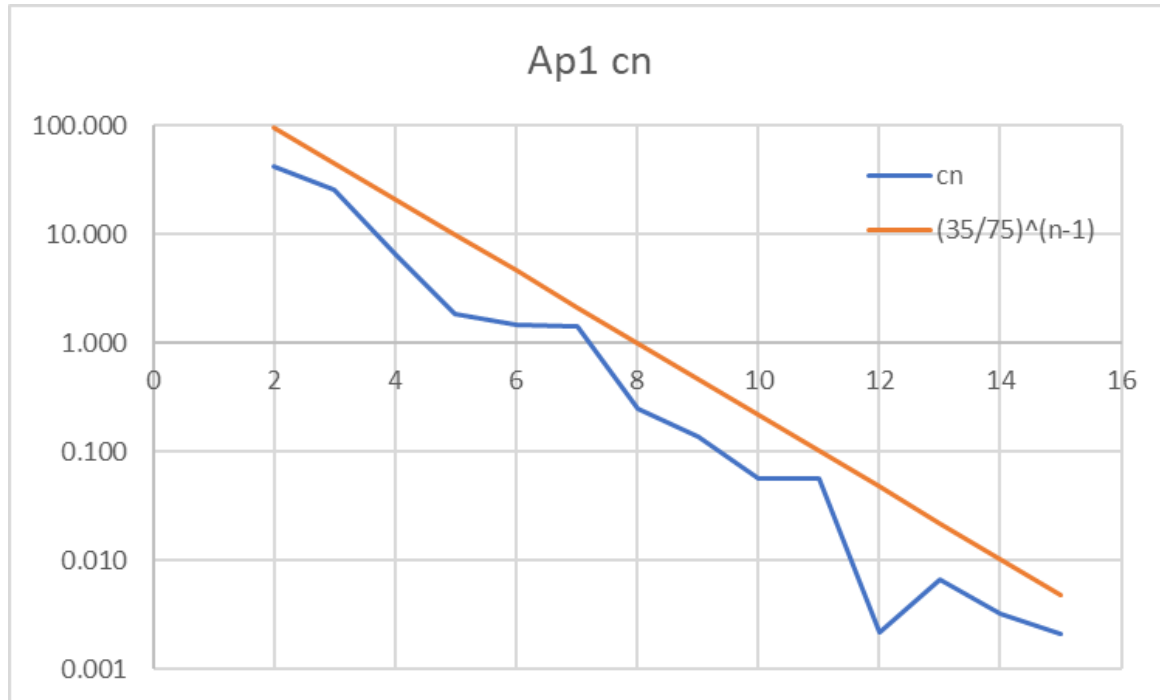
Tests at ambient temperature

- Scanning along z at 0.25 A

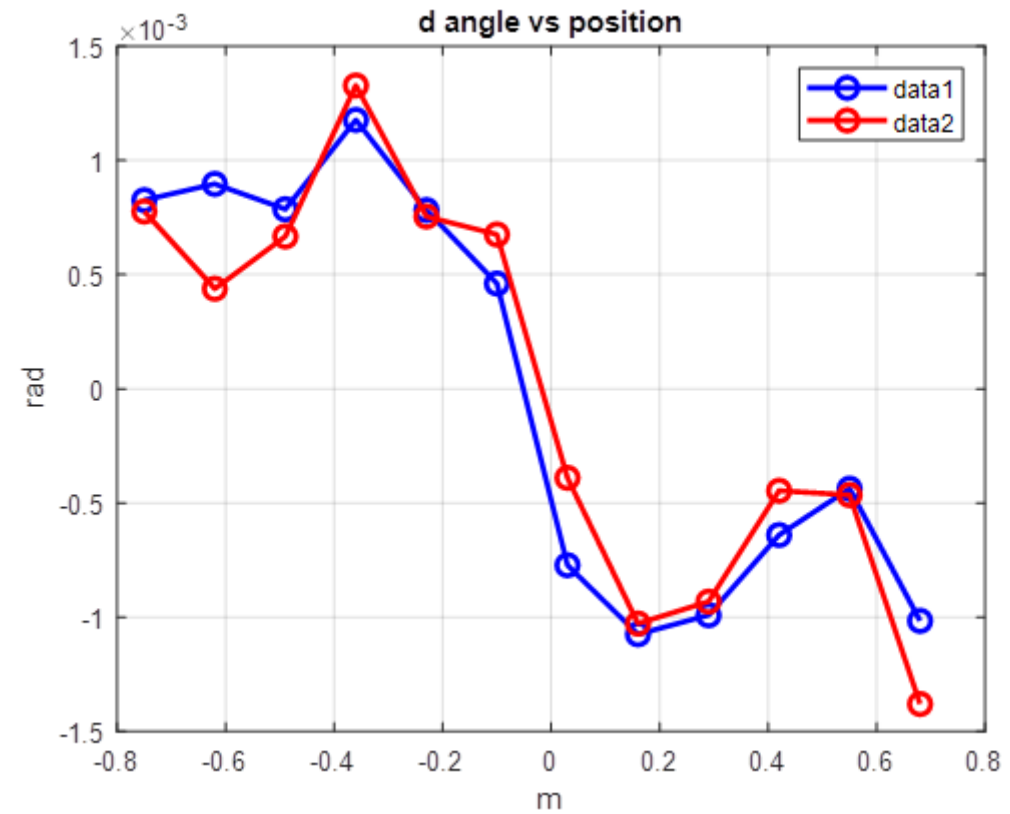
Harmonics along z



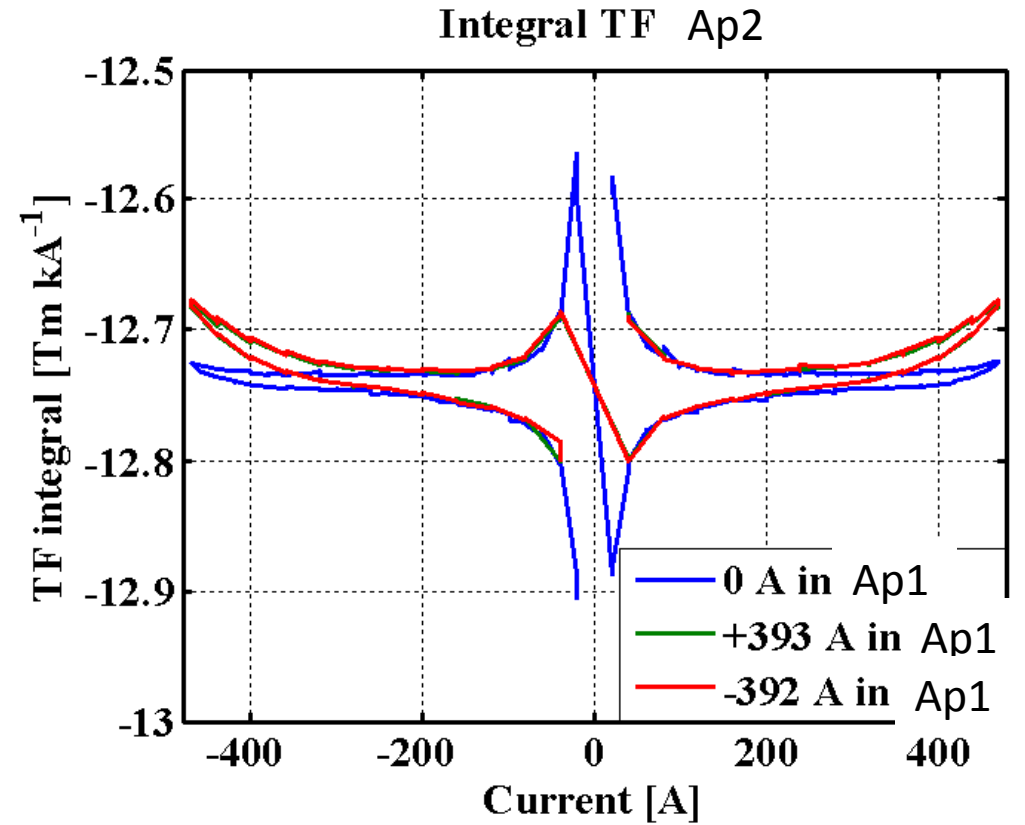
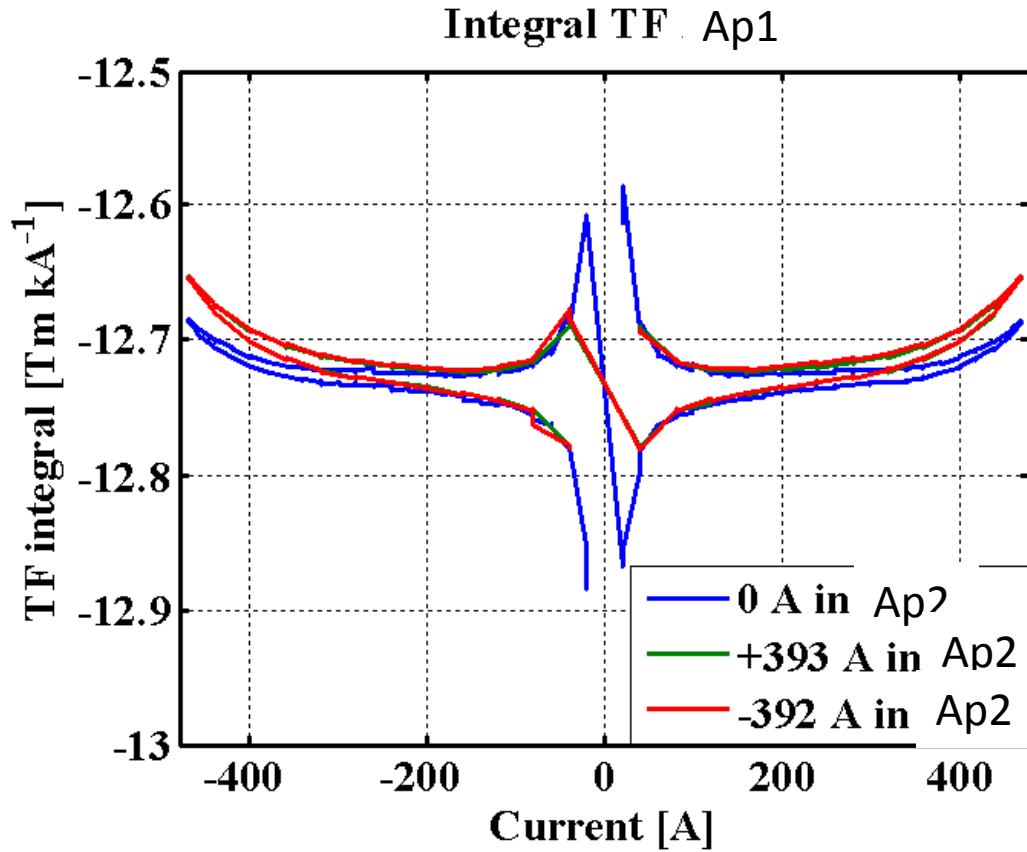
Radial position of the perturbation



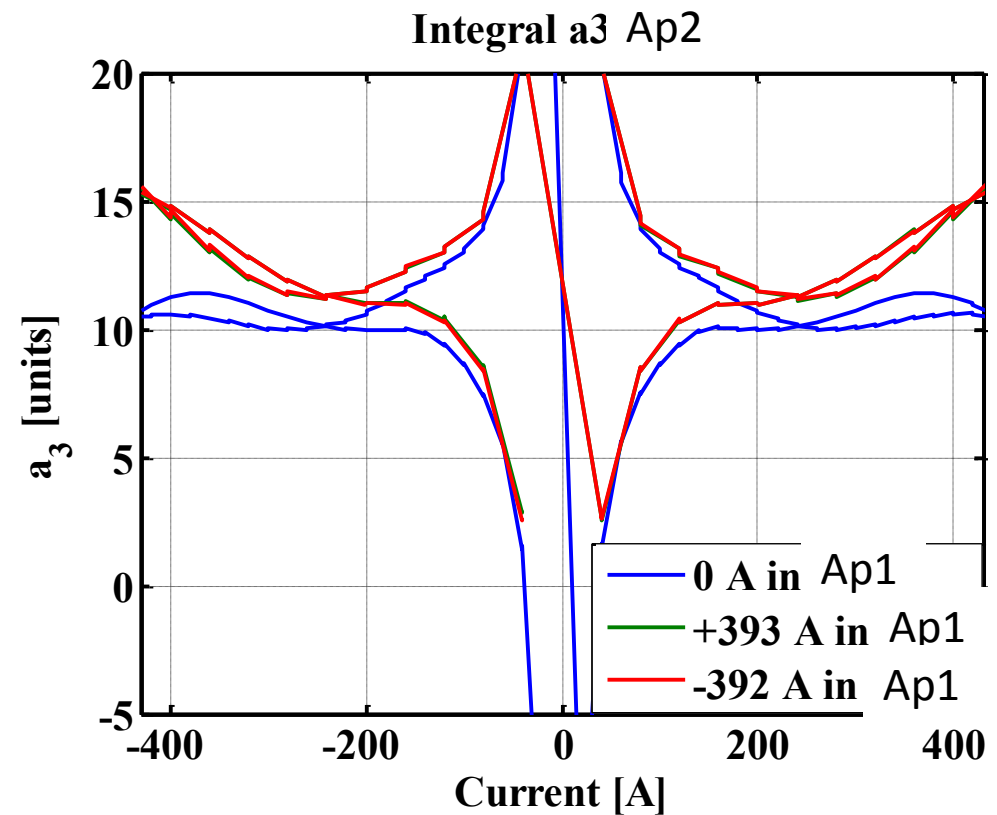
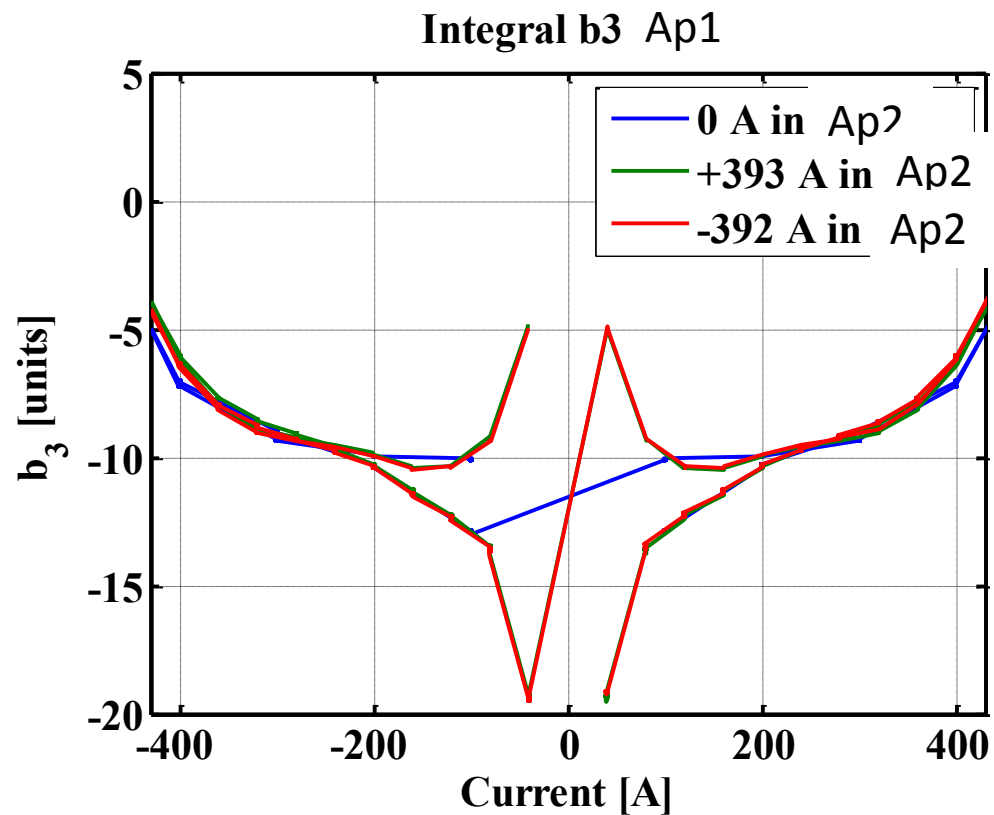
Field direction along z



Comparison with MCBRDP1 - TF



Comparison with MCBRDP1 – b3 / a3

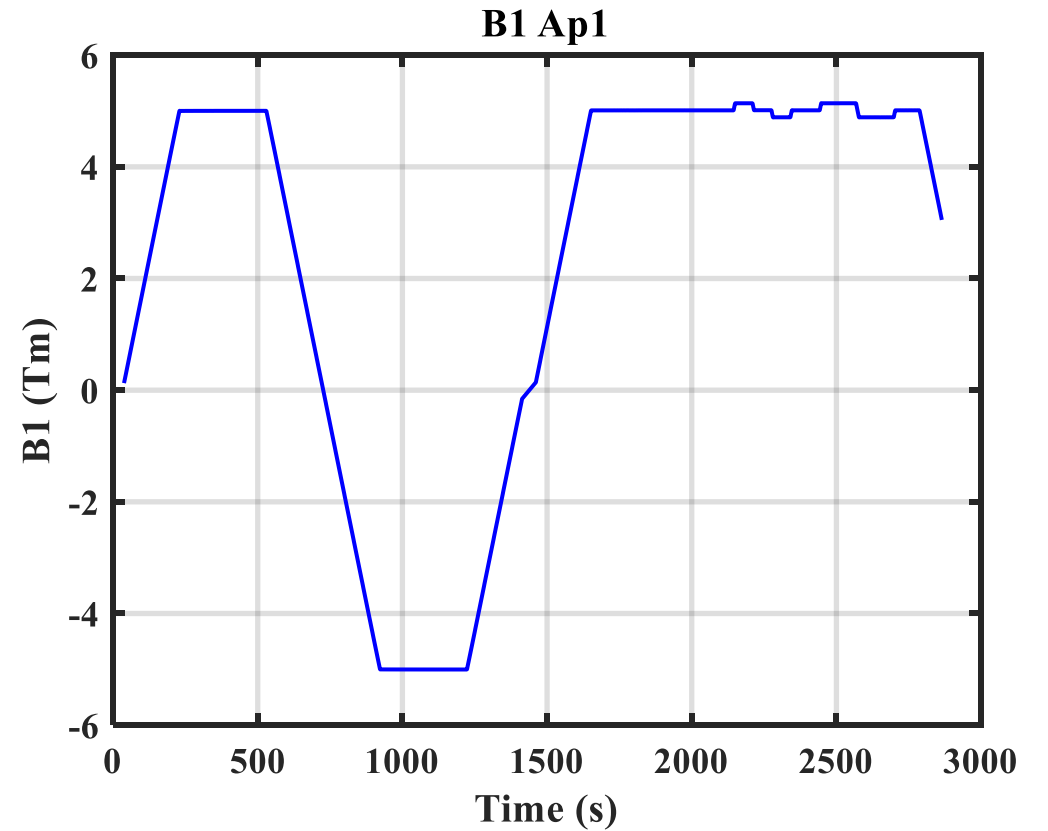
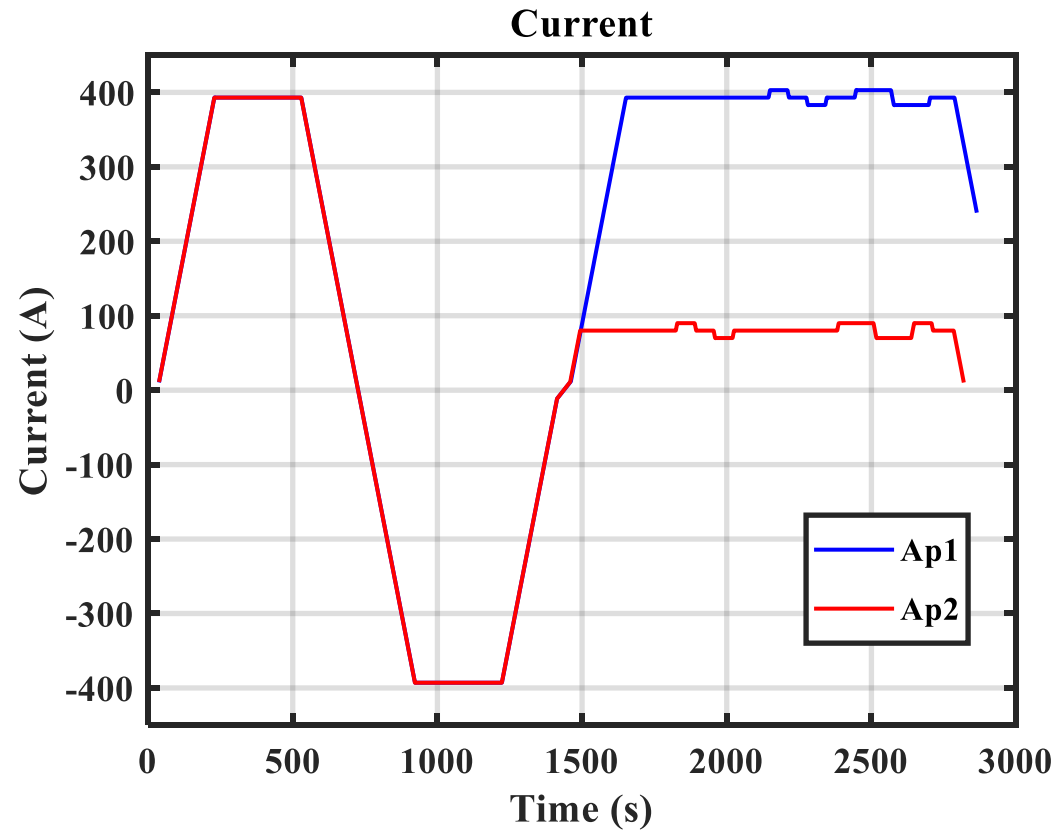


Conclusions

- From measurements at 1.9 K
 - TF within specifications (-1‰ of 5 Tm at 393 A) on both apertures
 - -13 units of b3 on Ap1 and 10 units of a3 on Ap2
 - Different behavior of saturation wrt MCBRDP1
- From measurements at ambient temperature
 - Field direction shows a change of 2 mrad in the center on both apertures
 - Larger low order multipoles
 - The source of the disturbance seems to be at ~75 mm
 - Keys got magnetized after tests at cold?

Additional slides

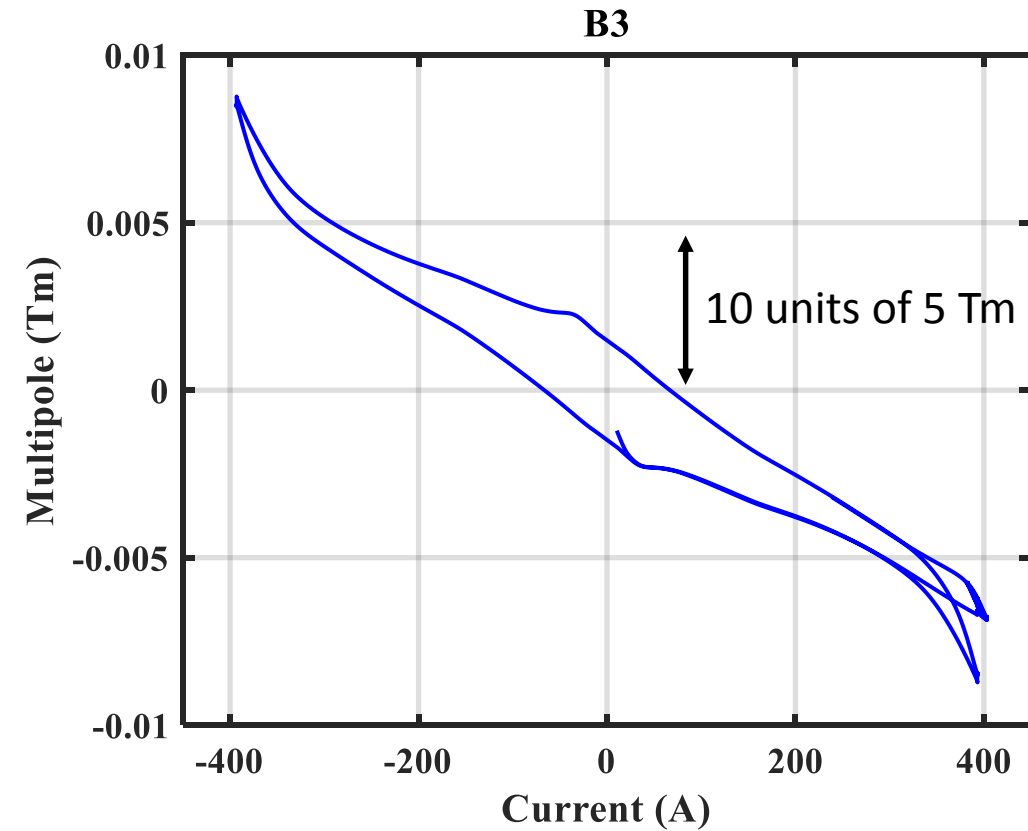
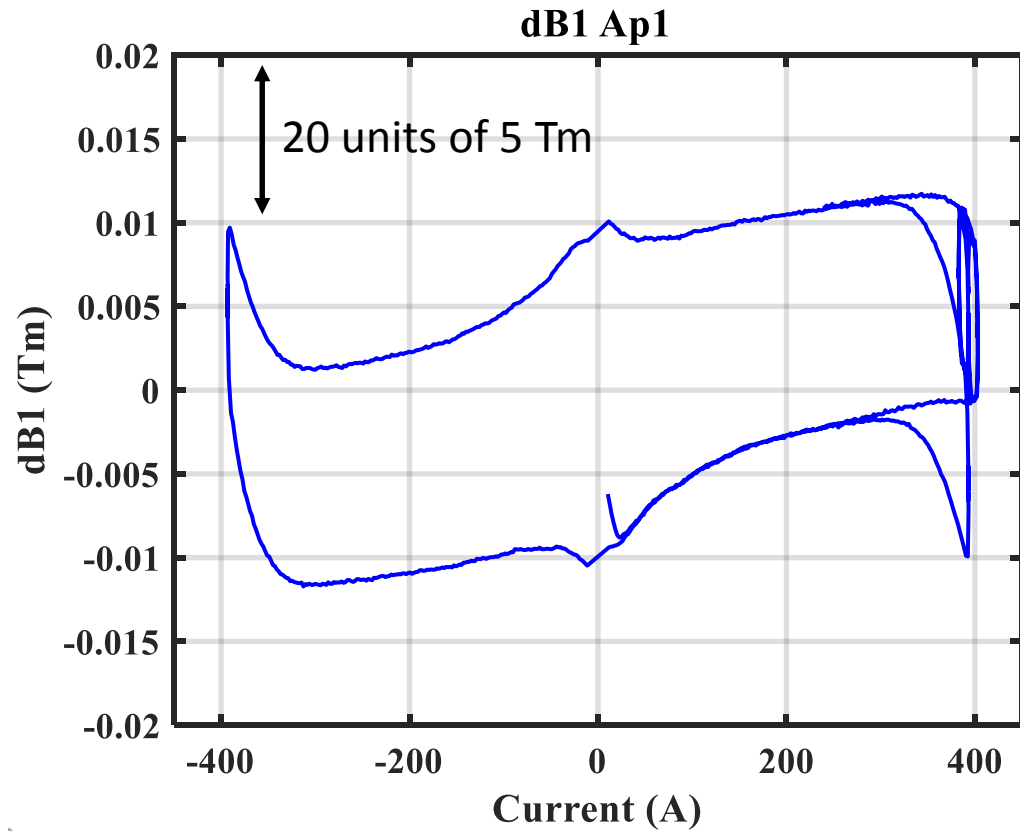
Special cycle 1 – Currents and main field Ap1



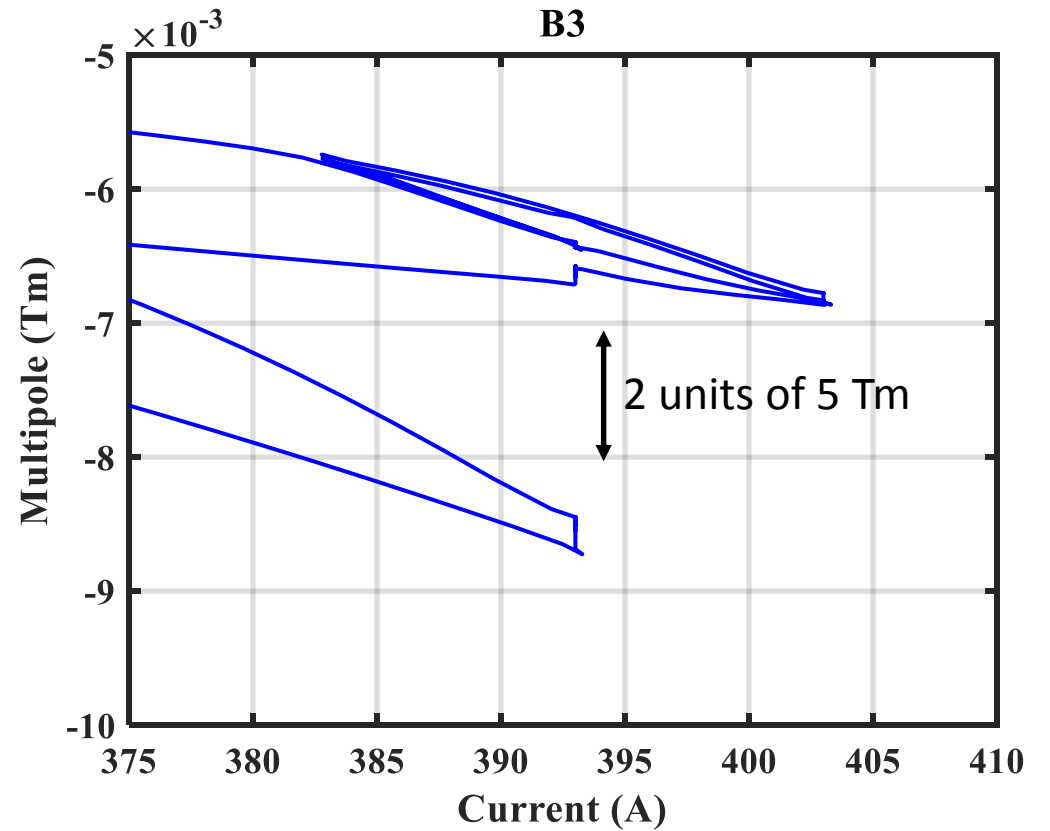
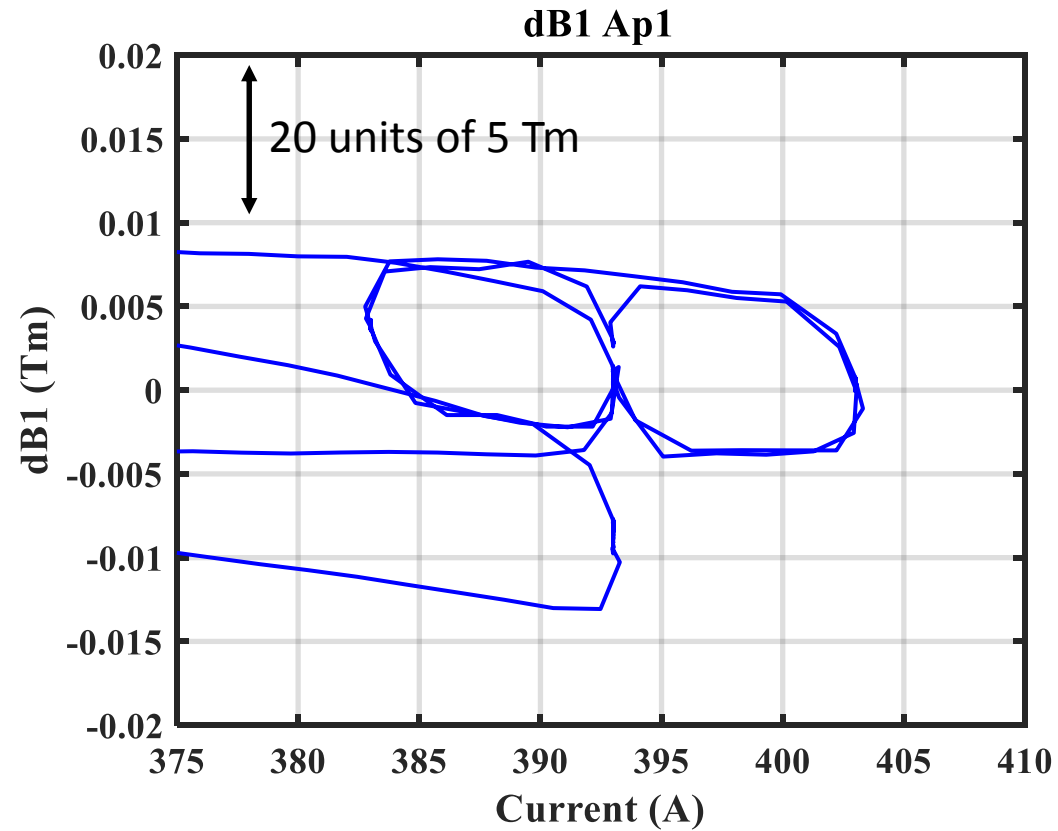
393 A (+/- 10 A) in Ap1 -> 5 Tm

80 A (+/- 10 A) in Ap2 -> 1 Tm

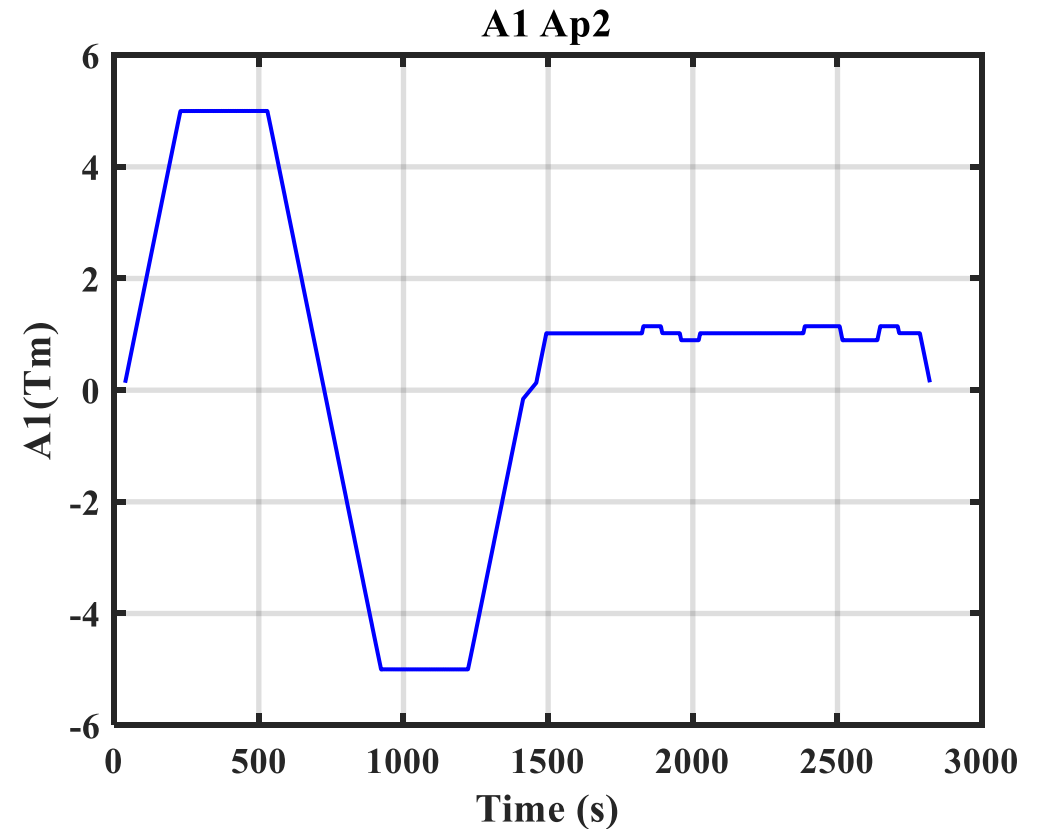
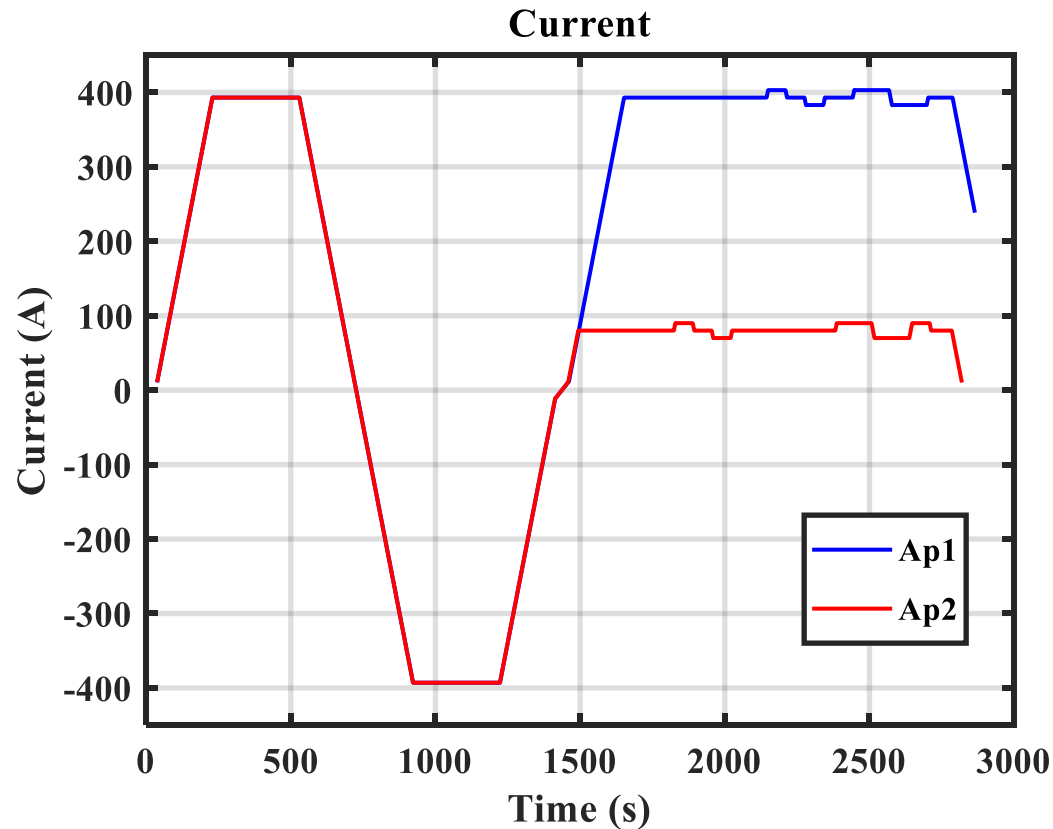
Special cycle 1 – hysteresis Ap1



Special cycle 1 – hysteresis (zoom) Ap1



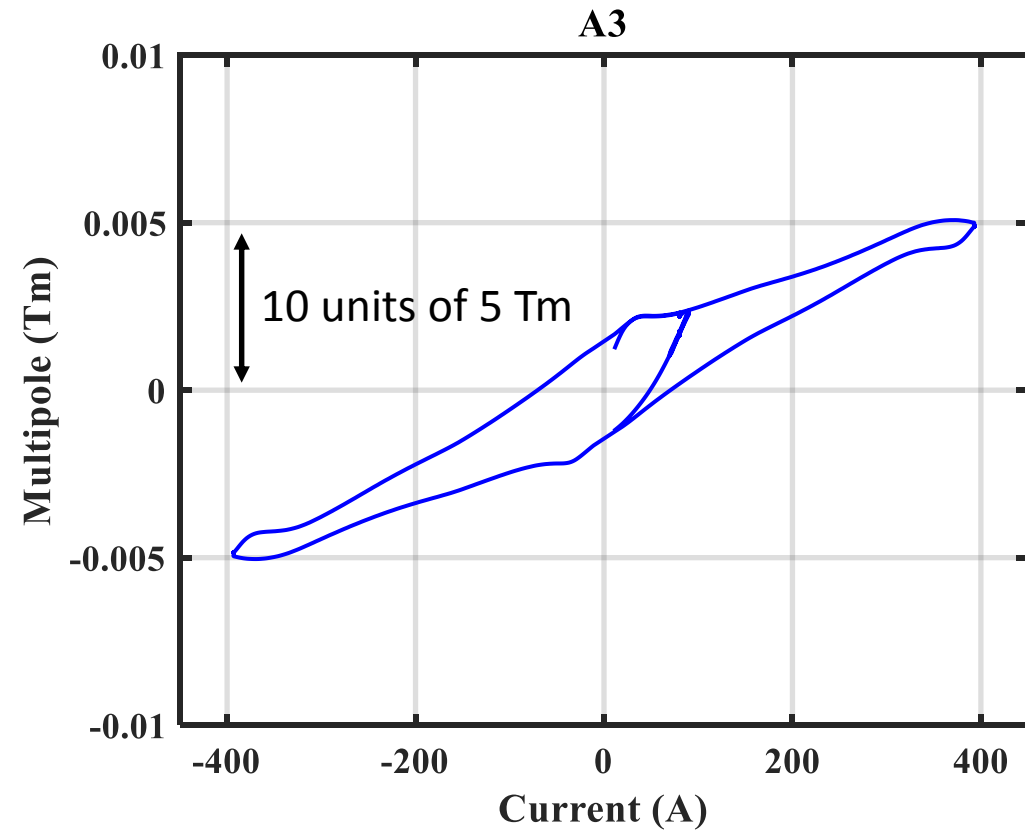
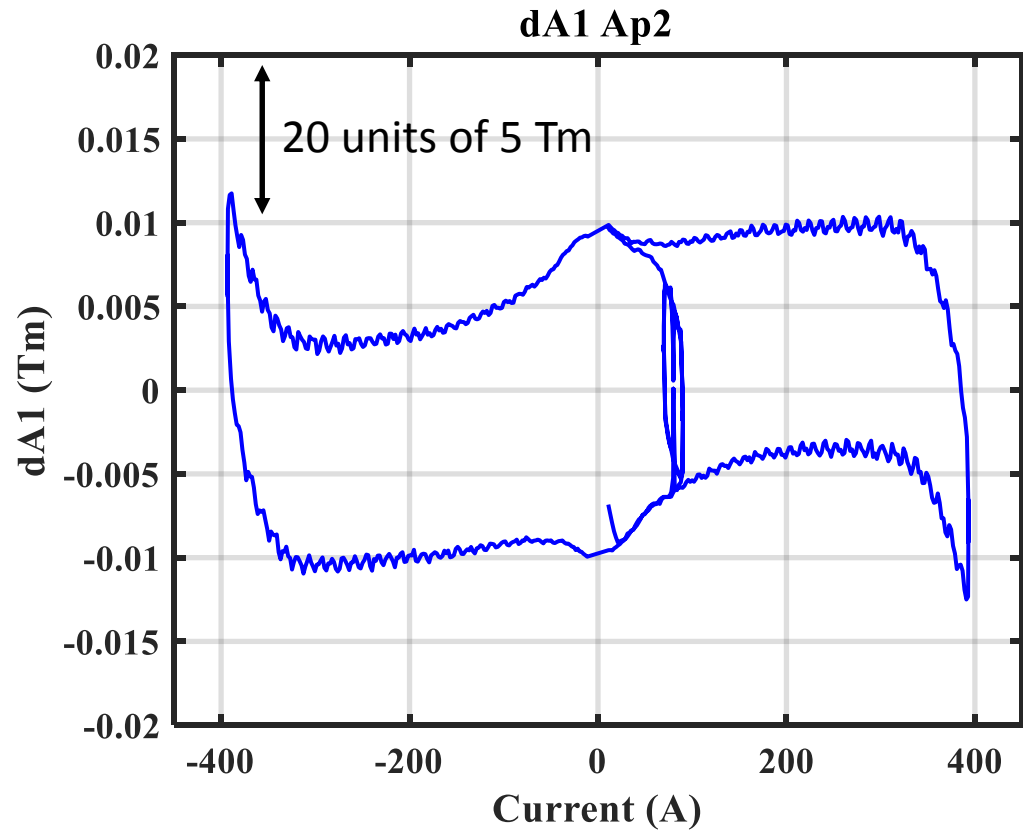
Special cycle 1 – Currents and main field Ap2



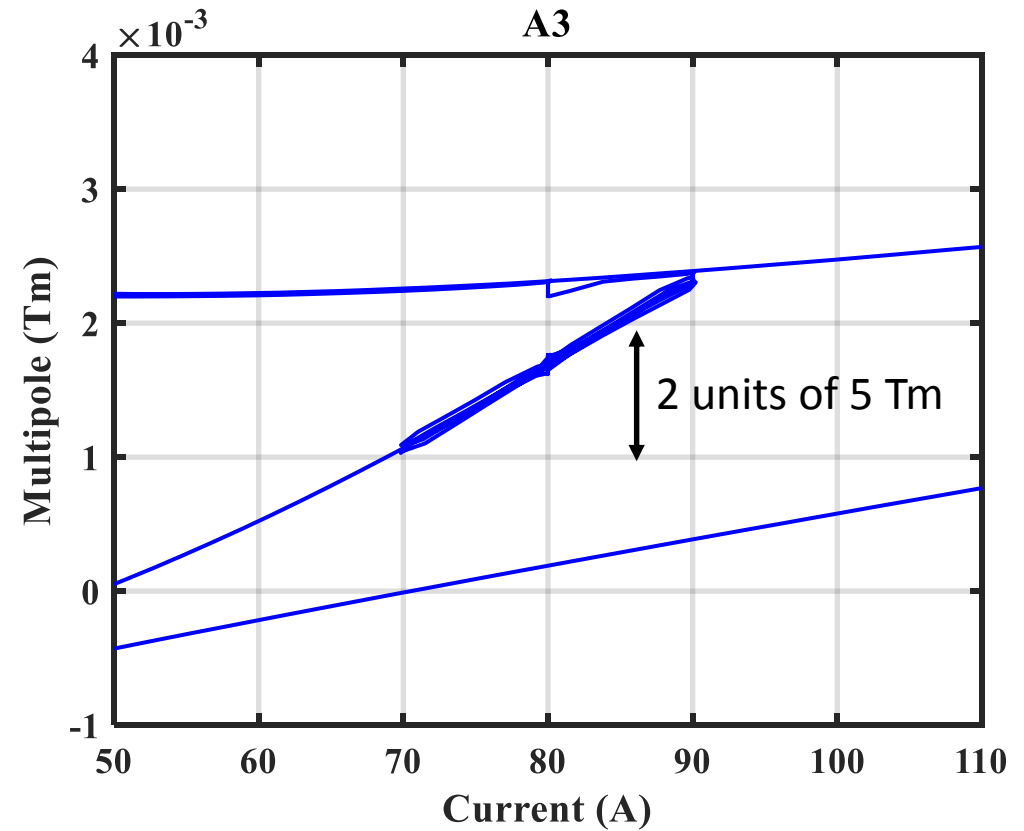
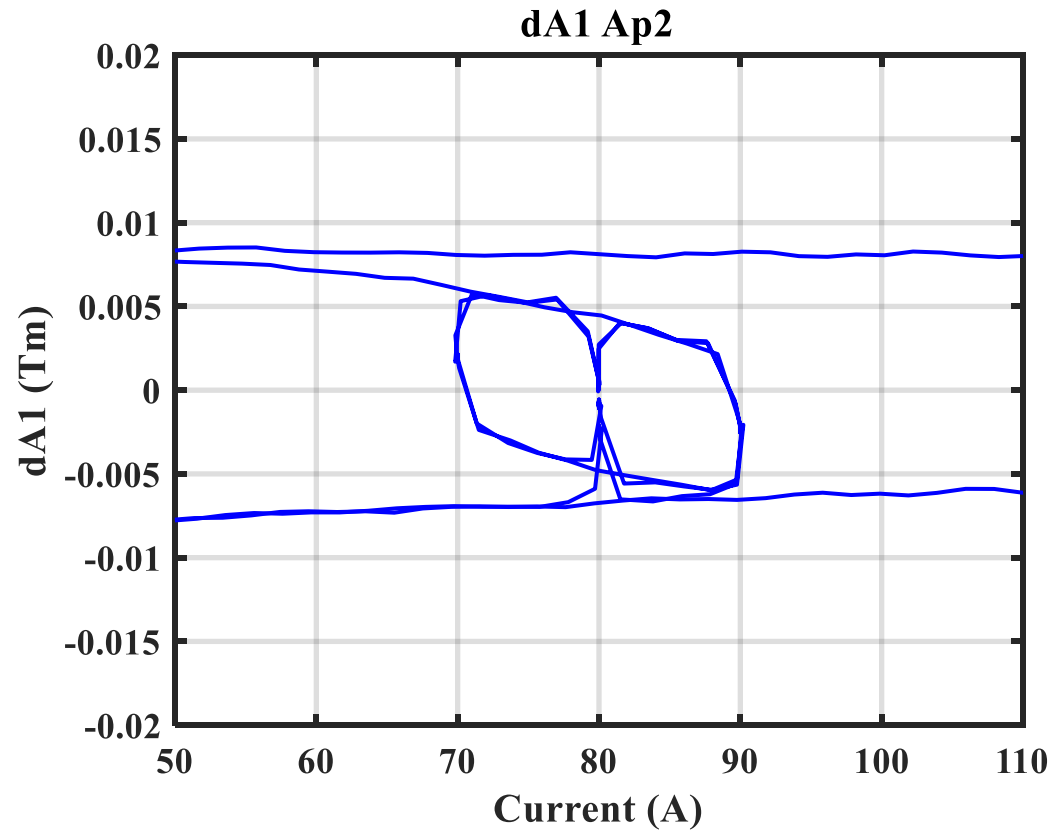
393 A (+/- 10 A) in Ap1 -> 5 Tm

80 A (+/- 10 A) in Ap2 -> 1 Tm

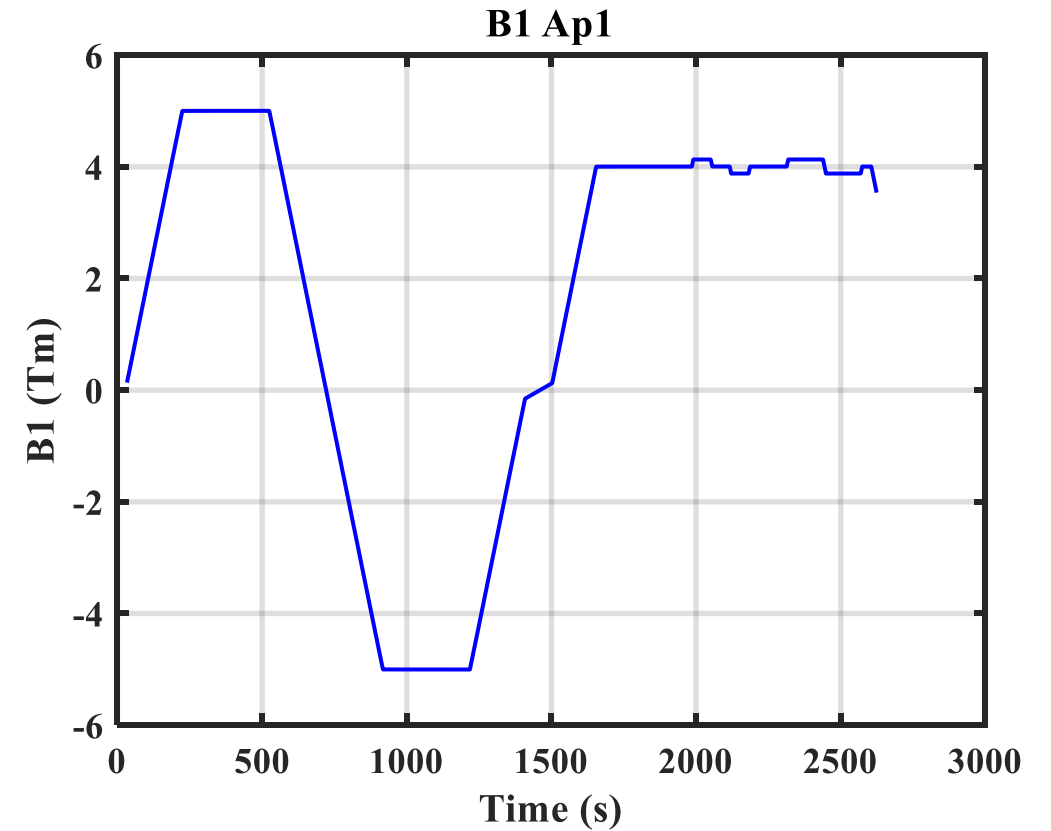
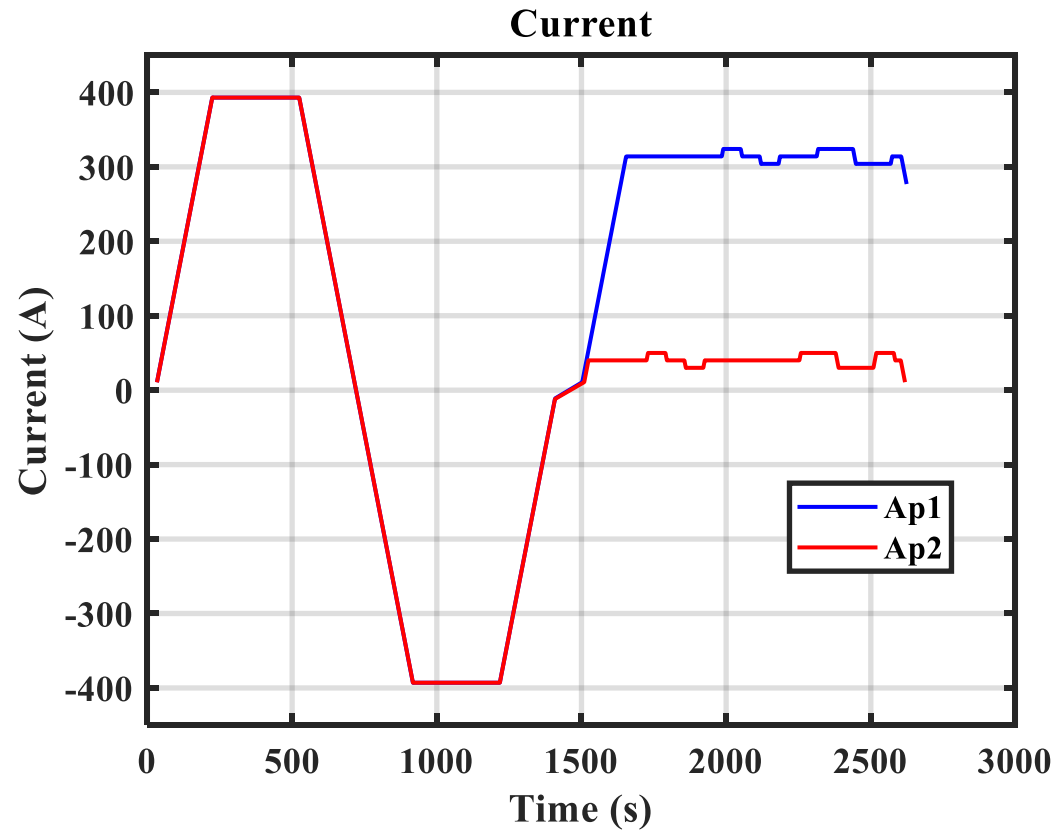
Special cycle 1 – hysteresis Ap2



Special cycle 1 – hysteresis (zoom) Ap2

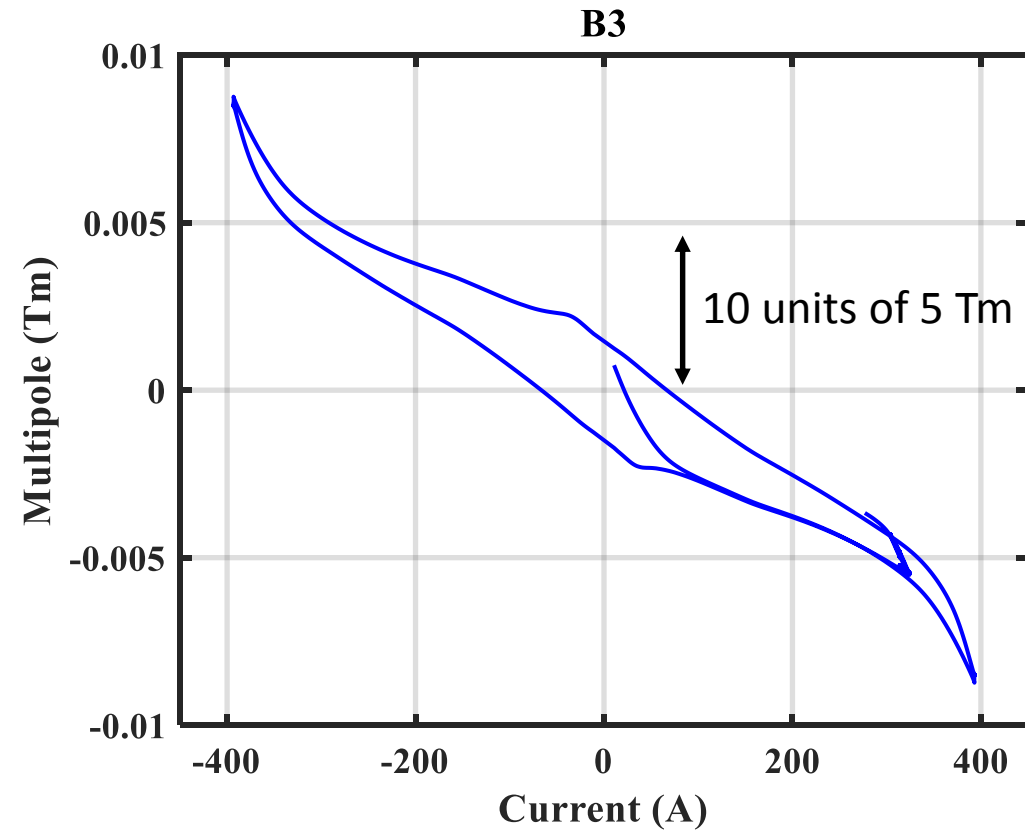
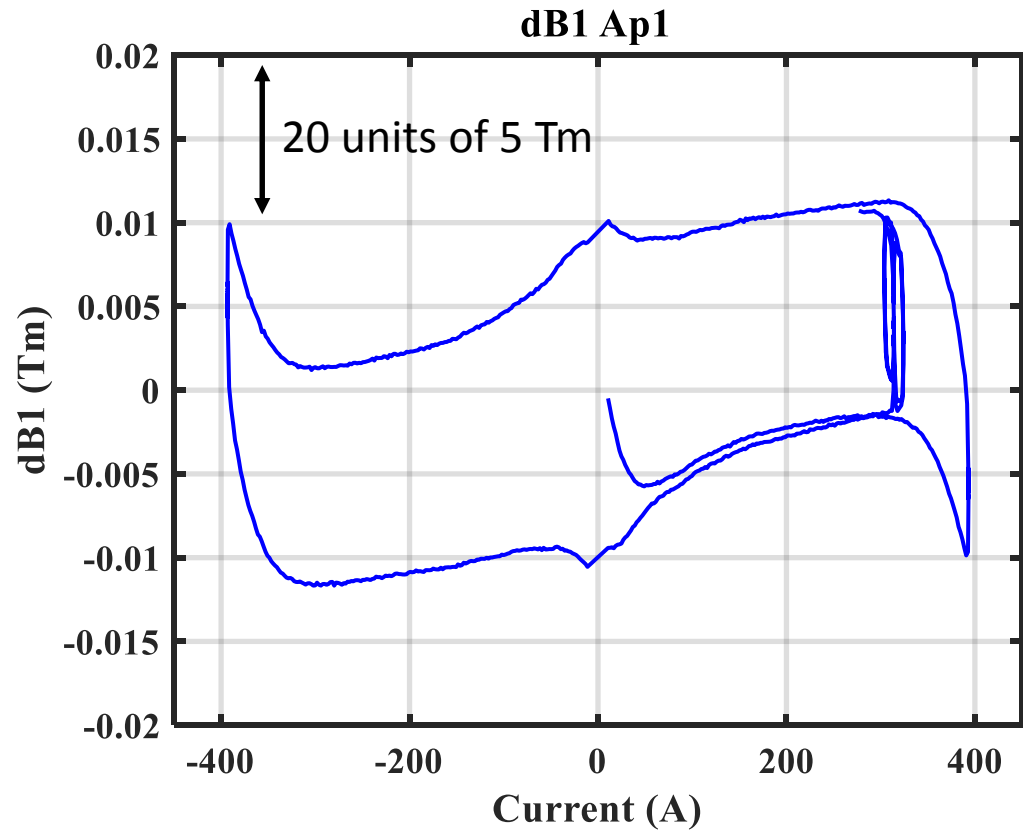


Special cycle 2 – Currents and main field Ap1

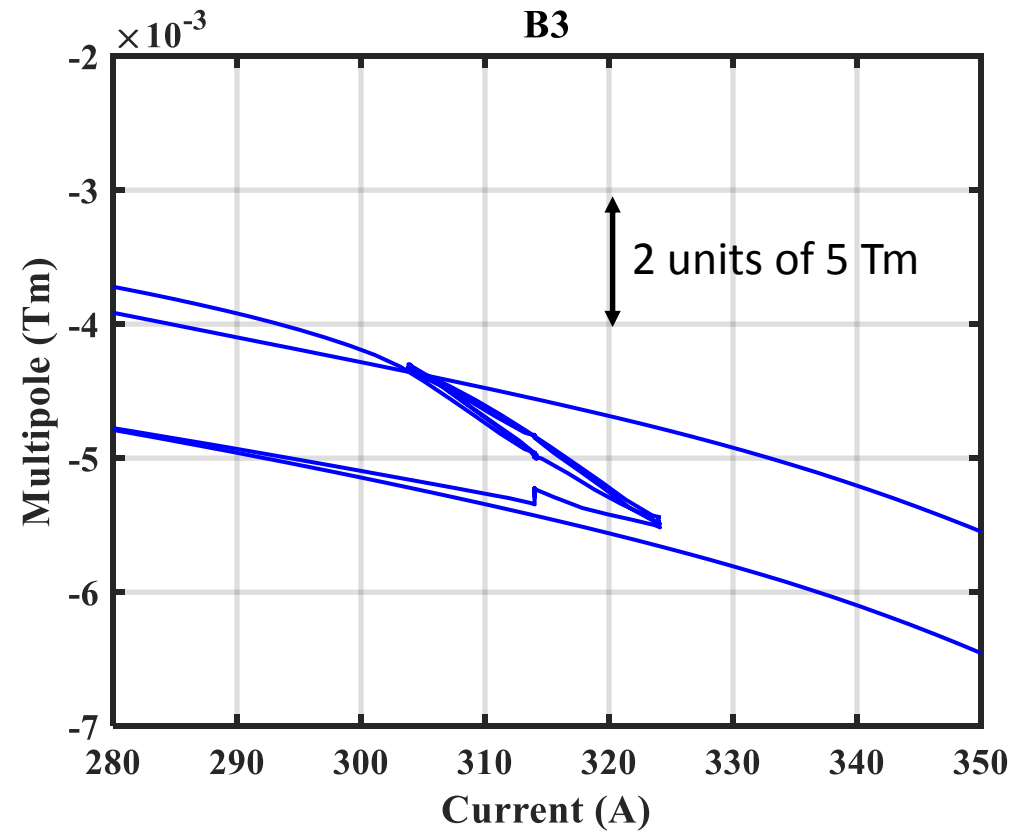
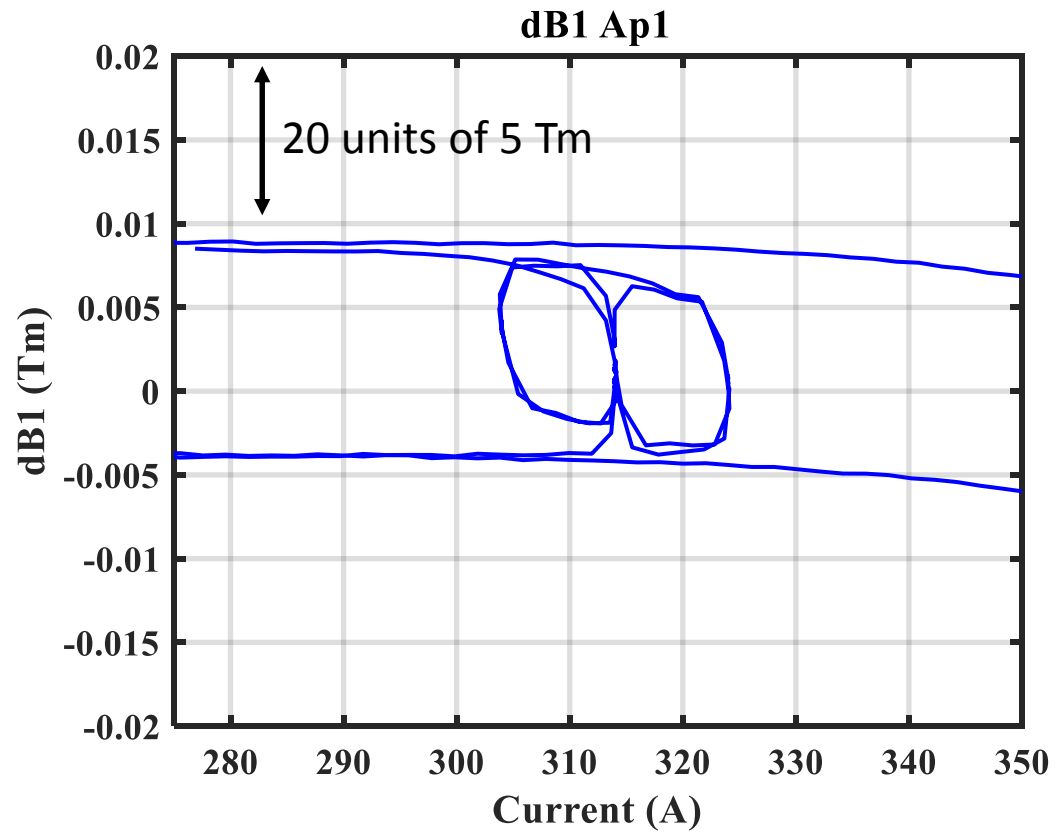


393 A (+/- 10 A) in Ap1 -> 4 Tm
80 A (+/- 10 A) in Ap2 -> 0.5 Tm

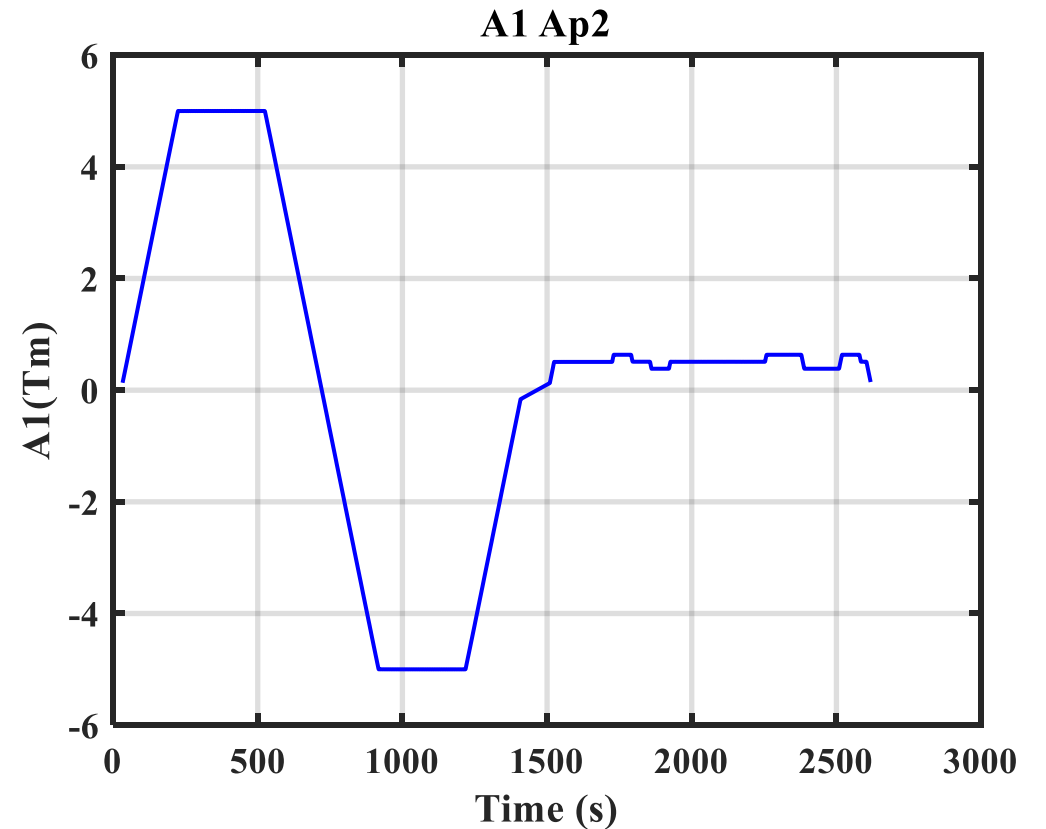
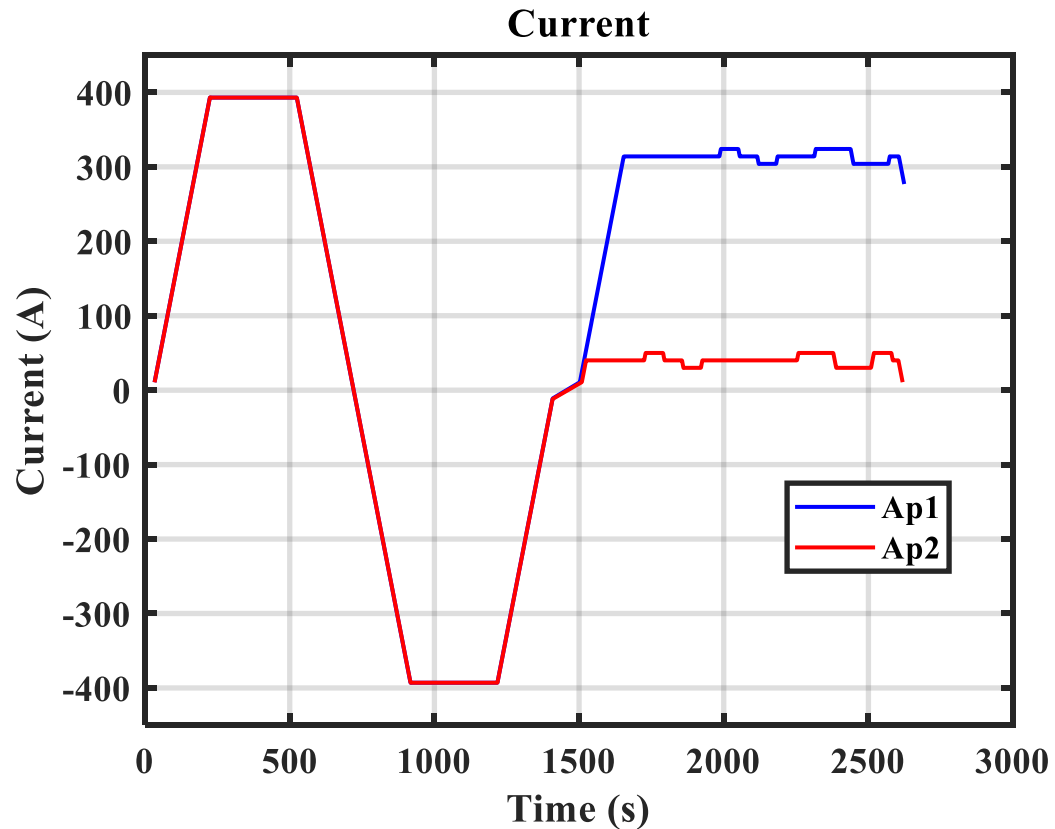
Special cycle 2 – Ap1 hysteresis



Special cycle 2 – hysteresis (zoom) Ap1

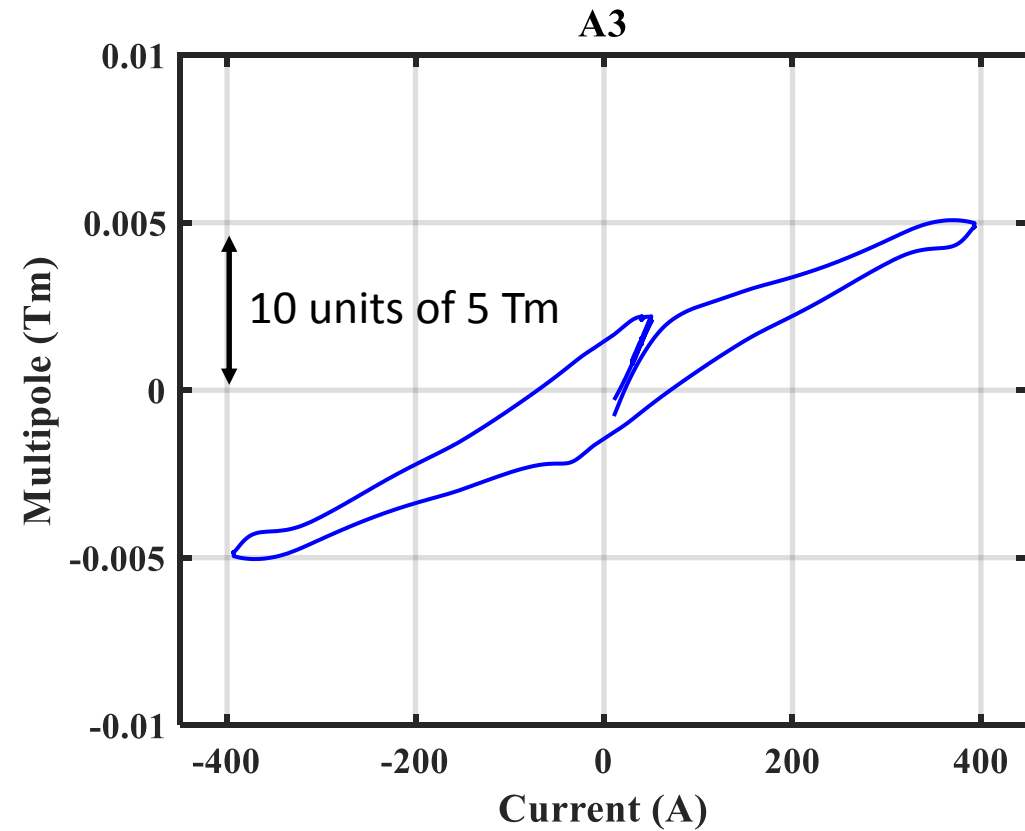
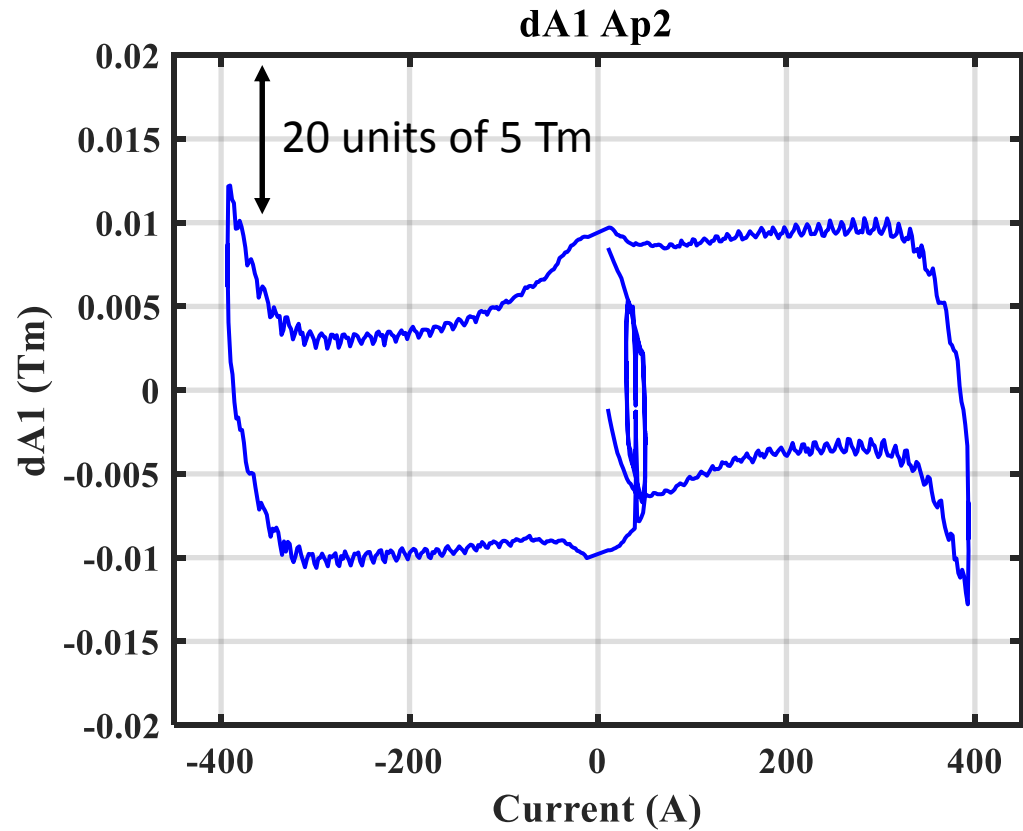


Special cycle 2 – Currents and main field Ap2



314 A (+/- 10 A) in Ap1 -> 4 Tm
40 A (+/- 10 A) in Ap2 -> 0.5 Tm

Special cycle 2 – hysteresis Ap2



Special cycle 2 – hysteresis (zoom) Ap2

